Thesis for the degree of D. Sc:

A Research in Egyptology:

The ancient Egyptian Canals between the Mediterranean & the Red Sea: their problems for the Sciences of Geology, Geography, Engineering, & History.

By William Menzies Alexander M.A: B.Sc: M.D: C.M.
11 St Roman's Ter: Morningside, Edinburgh.

Declaration:—

This Thesis is a record of original research undertaken by me and I hereby declare that the work has been done and the Thesis composed by myself entirely.

Wm. Menzies Alexander

11th Jan 1918.

ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 – 1346

Introduction.

(1) This research concerns itself with the Canals ascribed to (1) Sesostris: (2) Necho ii (3) Darius i (4) Ptolemy ii (5) Trajan: (6) Omar. These Canals all linked up the Mediterranean with the Red Sea, by way of the Wadi Tumilat – the narrow valley which, beginning from the neighbourhood of Zagazig, some 50 miles north east of Cairo, proceeds eastward to Ismailia, on the Suez Canal.

(2) The subject has hitherto been treated essentially upon literary principles & has led to conclusions of the most diverse sort. More than 20 of these are set out in pp 28-34 alone

(3) The subject has not hitherto been treated expressly upon the lines of the Sciences of Geology, Geography, Engineering, & History. That is done for the first time in this research.

(4) The Geological Problem concludes by showing that from the Post-pleistocene onwards until to-day an arm of the Nile has run through the Wadi Tumilat into the Red Sea (or Gulf of Suez) the Heroopolite Gulf of the ancient geographers

(5) The Geographical Problem concludes, inter alia, by showing that the Red Sea has always had a purely natural connection with the Nile-arm mentioned, in the region of Ismailia or Heroopolis-Pithom, until about 1350 A.D.

(6) The Engineering Problem shows that all the old canals were but canalizations of the Nile-arm mentioned as running through the Wadi Tumilat. The ordinary engineering formulae, therefore, do not apply. So-called excavations of this Wadi Tumilat Canal were never more than simple repairs, probably on a considerable scale at times. These Canals were only seasonal Canals, not perennial

(7) The Historical Problem shows that four canals are in view: (1) The Wadi Tumilat Canal: (2) A Heliopolite Canal: (3) An Isthmian or Northern Canal to run directly between the two Seas, repeatedly attempted, never carried out: (4) A Southern Canal running southwards on the line of the present Fresh-water Canal from Ismailia to Suez

Contents

Regularity of that regimen: Secular rise of river-bed & flood-plain: Shiftings of head of Delta. Relation to ancient canals: "Esp-lake" of the Wadi Tumilat Canals of the ancient Egyptians: Theoretical nilometer at Phacusa: Differences of level between the Mediterranean & the Red Sea: Views of Aristotle: Value of it by Pliny: Its factual character: its physical causation: The 'EUPITOS of the Ptolemaic Canal: Engineering Formulae: The old Wadi Tumilat canals seasonal, not perennial

IV. History of the ancient Canals between the two Seas 117-134

(1) No canal of Seti i: Balu in Kantarah.
(2) Wadi Tumilat canal of Sesostris as Ramses ii: Probably also an Isthmian or Northern Canal
(3) Necho's Wadi Tumilat Canal finished: Possible Isthmian Canal: His loss of 120,000 men: Of Mehemet Ali's losses.
(4) Darius Canal (1) Wadi Tumilat Canal certain: (2) Southern Canal also certain: (3) Probable attempt at Isthmian Canal
(5) Ptolemy's (1) Wadi Tumilat Canal: (2) Heliopolite Canal: Nine Canals for importation of Elephants
(6) Trajan's Heliopolite & Wadi Tumilat Canals. Nine for importation of porphyry & granite
(7) Canals Canal & Trajan's repaired

Maps.

(1) Egypt: p 136
(2) The Delta: p 138a
(3) The Wadi Tumilat: p 139
(4) The Red Sea Littoral: p 140a
(5) Profile of Suez Canal: p 141a
(6) The Delta (Talabat): p 144
(7) The Nile: p 145
(8) The Peutinger Map: p 146.
(9) Canal of Seti I (?): p 147.

Bibliography: at end: pp. 1-13.

× BVVBASTVS, now commonly called Bubastis

Textual Classical Sources:-

Herodotus. ii. 158-159: (c 450)

Now Necho was the son of Psammetichus and ruled over Egypt. He was the first to attempt the canal leading into the Red Sea, which Darius the Persian, excavated a second time. Its length is a four days' voyage, and its breadth was dug so that two triremes could sail abreast when rowed. The water for it is drawn from the Nile; & it is drawn a little above the city of Bubastis, passing by Patumos (Patoumos), the Arabian city and debouches into the Red Sea. The parts of the Egyptian plain to be first excavated lie towards Arabia, and above the plain is situated the mountain which stretches towards Memphis, in which are the quarries. Well, then, along the foot of this mountain, the canal is led lengthwise from west to east, and thereafter it extends towards the gorges, bearing away from the mountain, towards the south & south east into the Arabian Gulf. But at the point where lies the shortest and most direct route from the North Sea & the South Sea (which is the same as that called the Red Sea), from Mt. Kasios which divides Egypt from Syria - from this point to the Arabian Gulf - there are exactly 1000 stades. This is the minimum distance; but the canal itself is much longer, as

being more winding, and in the excavation of it, there perished in the reign of Necho, 120,000 Egyptians. Necho, who was then, in the midst of the work, ceased digging, as an oracle of this sort prevented him: "He was working for a barbarian". Now the Egyptians call all men barbarians who do not speak their language.

But Necho, having given up the canal, turned to military matters, and triremes were built, some on the Northern Sea, others on the Red Sea, in the Arabian Gulf. The slips of these are still to be seen; & he used these ships as he had occasion.

Book IV ch 39

Arabia terminates at the Arabian Gulf into which Darius carried a canal from the Nile

Bk IV ch. 42

When Necho had ceased digging the canal leading from the Nile to the Arabian Gulf, he sent out certain Phoenicians in ships, ordering them to sail back through the Pillars of Hercules into the Northern Sea & so to return to Egypt. The Phoenicians, accordingly, setting out from the Red Sea, navigated the Southern Sea. When autumn came, they went ashore & sowed the land by whatever part of

N.B. This circumnavigation of Africa has been confirmed by Bourrant's scarabs.

Libya they happened to be sailing & waited for harvest; then having reaped the corn, they sailed again. When two years had thus passed away, in the third, having doubled the Pillars of Hercules, they arrived in Egypt and told what does not seem very credible to me, but may to others, that they had the sun on their right hand as they sailed round Libya.

Aristotle: Meteora Bk I ch 14 (c 341)

The whole country of the Egyptians, whom we deem the most ancient of mankind, appears to be made, & to be the work of the river. And this is evident to one who surveys the country; and the parts bordering on the Red Sea are sufficient proofs of it likewise. For one of the kings attempted to dig a canal through the isthmus, as they would have secured no small advantages, had the whole region become navigable. Now Sesostris is said to have been the first to have attempted this, but he found the sea higher than the land. Therefore, he first, and Darius afterwards, ceased digging the canal, lest the water of the river might be spoiled by intermixture with that of the sea. It is evident, therefore, that the sea was once continuous (συνεχὴς) over all these parts

Diodorus Siculus: Bk i ch 33:

visited Egypt about the year 60 BC.

From the Pelusiac mouth of the Nile & the Arabian Gulf of the Red Sea, there is an artificial water-way. Necho, the son of Psammetichus, was the first to undertake this, and after him, Darius the Persian, who, having proceeded with the work up to a certain point, left it finally unfinished; for he was shown by certain men that, by cutting thro' the isthmus, he would cause the inundation of Egypt; for they pointed out that the Red sea was higher than the land of Egypt, to begin with. But Ptolemy ii afterwards completed the canal, & at the most convenient spot, constructed an ingenious lock (ξυλοτεχνον διαφραγμα). This he opened (ἐξηνοιγεν) for the passage of vessels, whenever he liked, then quickly closed it again: the operation being cleverly performed. Now the river (ποταμος) flowing thro' this canal (διωρυγι) is named after Ptolemy (πτολεμαιος), its constructor, & at its mouth (ἐκβολη) he had the city called Arsinoë

Strabo: Bk i ch ii § 13:

ascends the Nile to Syene with Aelius Gallus, prefect of Egypt: 24 BC

As to the navigation of the isthmus (of Suez) or one of the canals (of Egypt) if it had been related by Homer himself, we should have counted it a myth; but as he does not relate it, we regard

it as entirely extravagant & unworthy of belief. We say, unworthy of belief, because before the time of the Trojan war (πρὸ τῶν Τρωικῶν) there was no canal. It is recorded that Sesostris, who had planned the formation of one, apprehending that the level of the sea was too high to admit of it, desisted from the undertaking

Book XVI ch iv. § 23

Gallus built not less than 80 biremes & triremes & galleys at Celestatis near the old canal (πρὸς τῇ παλαιᾷ διώρυχι) which leads from the Nile

Book XVII ch i. §§ 25. 26.

There is another canal also, which empties itself into the Red Sea or Arabian Gulf, near the city Arsinoe, which some call Cleopatris. It flows through the so-called Bitter Lakes (διὰ τῶν πικρῶν καλουμένων λιμνῶν), which were formerly bitter (πικραί), but when the foregoing canal was cut, the bitter quality was altered by intermixture with the water of the River, & now they are well stocked with fish & full of water-fowl (λιμναίων ὀρνέων). The canal was cut originally (κατ' ἀρχάς) by Sesostris before the Trojan war (πρὸ τῶν Τρωικῶν), but, according to other writers, (Necho) of the son of Psammetichus, who only began the work & then died, but subsequently by Darius I, who succeeded to

καὶ οὐτὸν ἐπιτηδᾶν τὸν ἔνριπον, ὥστε ὅτε βουλοίντο,
ἐκπλεῖν ἀκωλυτῶς εἰς τὴν ἔξω θαλατταν καὶ εἰσπλεῖν πάλιν

Πλησίον δὲ τῆς Ἀφροίνης, καὶ ἡ τῶν Ἡρώων ἐστὶ
νῆσος καὶ ἡ Κασσιτερὶς ἐν τῷ μυχῷ ...

& the completion of the work; & he, trusting to an erroneous opinion, left off the work, now nearing its completion; for he believed that the Red Sea was higher than the land of Egypt & believed that Egypt would be overwhelmed by the sea, if the intervening isthmus were all cut through. The Ptolemaic kings, however, having cut it through, closed the tidal-channel (ἔυριπους) (by a sluice), so that, whenever they wished, they sailed without hindrance into the outer sea & back again. ....

(26) Near Arsinoe are situated in the recess of the Arabian Gulf towards Egypt, are the cities of Heroopolis & Clysmates; also harbours & suburbs; more canals & lakes are also near them. Here also is the nome & city of Phagroriopolis (city of reeds). The canal which empties itself into the Red Sea, begins at Phacoussa (Phaccousa?), & which the village of Philo is adjacent. The breadth of the canal is 100 cubits, its depth is such as is sufficient for vessels of the largest tonnage (μυριοφόροι). These places are near the apex of the Delta

Plutarch: Life of Antony ch iii: c 100 A.D

The soldiers of Gabinius feared the march to Pelusium more than the war; for they had to pass over a sandy & waterless track of country, past the effluvia of the Serbonian Bog, which the Egyptians called the exhalations of Typhon, but it seems to be due to the ooze & percolation of the Red Sea,

"Historia Naturalis" published 77 A.D.

when the latter is separated from the Mediterranean by a very narrow neck of land

Chapter XIX

When Antony arrived at Alexandria, he found Cleopatra engaged in a great and perilous enterprise; for, over the neck of land, which divides the Red Sea from the Mediterranean & is regarded as the dividing line between Asia & Africa (Libya) – over this space, I say – which at its point of greatest contraction between the two seas is less than 300 stades, – Cleopatra formed a project of dragging her fleet & launching her ships in the Gulf of Arabia, and so settle abroad with her many treasures & forces, thus escaping slavery & war. But when the Arabs around Petra burnt the first ships drawn over and Antony thought that his army was still in existence at Actium, she stopped & began to fortify the approaches of her kingdom

Pliny, the elder: Nat. Hist: Bk VI. ch 33: c 75 A.D

en passing the Arabian Gulf. There is another Gulf called by the Arabs Aeant, on which is situated the town of Heroum. Here also formerly stood the town of Cambysis, between the Neli & the Marchadae: the invaders of Cambyses having been settled there. Then

* Another reading is "40 ft"

comes the tribe of the Syrians (gens Syra) & port Daneon (portus Daneon). From the latter place, an attempt was made & form a navigable canal (alveus) & the River Nile, at the point where it enters the Delta so-called: the distance between the River & the Red Sea being 62 miles (M.P.). Sesostris, king of Egypt, was the first of all men & think of it, then Darius, king of Persia; then, at a later stage, Ptolemy (ii) who also made a canal 100 ft. broad, 30 ft. deep, & 37 (or 37·5) miles (M.P.) up & the Bitter Fountains (usque ad Fontes Amaros) Fear of an inundation kept him from going further with this work, as it had been discovered that the Red Sea was higher than the land in the interior of Egypt, by three cubits. Some authors do not allege that as the real cause, but (great reason) the fear that the water of the Nile would be spoiled by the introduction of sea-water: the former being the only source of supply. Be that as it may, the whole of the journey from the Egyptian (Mediterranean) Sea is usually performed over-land by one of three routes:— In travelling the one from Pelusium, the track over the sands cannot be found except by the help of reeds stuck in the sands, as the wind obliterates all traces at once. The second route begins two miles beyond Mt. Kasios, & after 60 miles, it joins the road from Pelusium. The Ascan Arabs dwell there. The third route [illegible],

(Amnis Ptolemaeus)

from Serbon, which they call "the Thrusters", passes thro' the same Arabs, & is nearly 60 miles shorter, but it is rugged with mountains and ill-supplied with water. At the head, roads lead to Arsinoe, a city founded on the Bay of Heroonpolis (in Sinu Heroonpolitico) by Ptolemy Philadelphus in honour of his sister's name. He was the first to explore the land of the Troglodytes and called the canal which flows past Arsinoe by the name of Ptolemy (... amnem quae Arsinoen praefluit, Ptolemaeum appellavit.)

Claude Ptolemy: Geographia IV cf V: c 150 A.D.

Heroopolis	Long. 63° - 10'	Lat 30° - 10'
Babylon	Long. 62° - 15'	Lat 30° - 0'

"The Heroopolis & the city of Babylon flows Trajan's canal"
- Ἡ μεταξὺ πόλις - δι' ἧς καὶ Βαβυλωνος πόλεως Τραϊανὸς ποταμὸς ῥεῖ

Analysis of the foregoing statements

These reveal the existence of not less than four canals: —

1 Those in the Wadi Tumilat, following generally the line of the modern Freshwater Canal from the vicinity of Ismailia

(This, for the sake of convenience, we shall henceforth call the

Wadi Tumilat Canal. In whole or in part it is associated with the names of Sesostris, Necho, Darius, Ptolemy ii, Trajan and Omar.

II A subsidiary canal which ran from the head of the Delta and joined the Wadi Tumilat Canal near its western extremity, at the mouth of the Wadi Tumilat. This, for the sake of convenience, we shall henceforth call the Heliopolite Canal, as it is shown in the legend to be the old Egyptian canal of the Heliopolite nome. It is associated with the names of Ptolemy ii (Pithom stele), Trajan and Omar

III A canal to run over the Isthmus of Suez from the Mediterranean to the region of the Wadi Tumilat near Ismailia. This canal was already projected or attempted but never completed in ancient times. For the sake of convenience, we shall henceforth call it the Isthmian or Northern Canal. It is associated with the names of Sesostris, Necho (?), Darius, the Caliphs Omar and Haroun er-Rashid.

IV A canal, running southwards from the eastern extremity of the Wadi Tumilat Canal, along the general course of Fresh-water Canal of To-day from Nefisha to a point a few miles north of Suez. This, for the sake

of convenience, we shall henceforth call the Southern Canal. It is associated with the name of Darius I of.

(1) Herodotus knows of the wadi Tumilat Canal as ending at Patumos. He has a confused idea of the Southern Canal

(2) Aristotle refers exclusively to the Northern Canal. He is provided with more or less intelligence by Diodorus, Strabo, & Pliny

(3) Diodorus refers to (1) the Wadi Tumilat Canal; (2) the Northern Canal. His ideas about the latter are highly nebulous.

(4) Strabo refers to (1) the wadi Tumilat Canal: (2) the Northern Canal. His ideas about the latter are Aristotelian

(5) Pliny knows of (1) the Wadi Tumilat Canal: (2) the Northern Canal: (3) the Heliopolite Canal. His ideas of the Northern Canal are confused in the highest degree

(6) Ptolemy knows of (1) the Heliopolite Canal: (2) the Wadi Tumilat Canal: (1) and (2) conjoined, forming Trajans Canal

Views of certain Modern Authorities.

It is necessary to refer to these as showing the status quo of our research. The literature here is very large but space permits only brief reference to leading modern writers on this subject:-

I M. Rozière: one of the staff of Napoleons Engineers:- Description de l'Egypte: Antiquités Mémoires: Tome i. Pt i: pp 127-166

According to the ancients, Seostris was the first to attempt a connection between the Nile & the Red Sea. Necho eagerly followed up the execution of this project & was only stopped by the difficulties of the work & the discovery that the Red Sea was higher than the land of Egypt. This fear was well founded,* for Strabo, Pliny & others. Darius did not suffer himself to be moved by the fears of Necho regarding the Red Sea. He wanted a connection between the Nile & the Red Sea for bringing together his empire, all the more that Scylax had reconnoitred the route from India to Egypt. In the end, his engineers discovered the reality of the difference between the Red Sea & the land of Egypt, so that Darius abandoned the work. All authorities are agreed that

* The erroneous levels of Napoleons Engineers are here in view

the Egyptian & Persian kings conducted the Nile & the Bitter Lakes only. Ptolemy ii completed the canal abandoned by Necho & Darius; his special part being the construction of the line between the Bitter Lakes & the Arabian Gulf towards Arsinoe* This was called the River of Ptolemy. Ptolemy used sluices against the tidal waters of the Red Sea. By his canal the waters of the Bitter Lakes were sweetened. This canal was silted by the time of Cleopatra (c 30 B.C.). Communication between the Nile & the Red Sea was re-opened during the reigns of Trajan & Hadrian by a new canal which had its origin at Babylon & ended at Saba Biar (on the eastern extremity of the Wadi Tumilat).

ii K. R. Lepsius: Die Chronologie: p 356 (1849)

The result we have arrived at with regard to the whole history of this remarkable canal is briefly as follows:-

(1) c 1350 BC: Ramses ii (Sesostris) digs this canal from Bubastis to Heroopolis (=Muk'far), & with the help of the Israelites, builds near it the towns of Pithom & Ramses

(2) c 600 BC: Neko appears to have constructed the canal as

* Placed by our author at 1·5 hour north of Suez

for as the Bitter Lakes, but no further. [There were two cuttings to be undertaken: (a) one between Saba Biar, at the eastern end of the modern Ismailat, up to the Bitter Lakes, about 7000 metres in length: (b) another between the Bitter Lakes & the Red Sea, four times as long. Necho cut through the first & left the second unfinished]*

(3) c 500 BC: Darius, for the first time, makes the whole connection, since he cuts through the elevation between the Bitter Lakes & the Sea (c.c. (b) ut supra: alias Chalouf of Map.

(4) c 350 BC: At the time of Aristotle, the canal seems to have fallen into disuse

(5) c 250 BC: Ptolemy Philadelphus digs a wide canal, the Amnis Ptolemaeus, from the (Red) Sea to the Bitter Lakes, constructs an ingenious sluice & builds Arsinoe, near the (Red) Sea

(6) c 100 AD: Trajan opens a new canal, the Amnis Trajanus, from Babylon to Heroopolis

(7) c 643 (644) AD: Omar re-opens the interrupted connection.

(8) c 762 (767) AD: Mohammed ben Abdullah fills up the canal.

* Cf also Lepsius: Egypt, Ethiopia, & Sinai: pp 342. 344. 345.

III Theodor Mommsen: Provinces of the Roman Empire: ii. 297-299

e Following apparently in the traces of older structures of Seti i & Rameses ii, Necho ii (610-594 BC) began the building of a canal, which branching from the Nile in the neighbourhood of Cairo, was to furnish a water-communication with the Bitter Lakes near Ismailia & thus thence with the Red Sea, without however, being able to complete the work. That he had in view, not only the control of the Arabian Gulf & the commerce of the Arabians, but that he had already brought within his horizon the Persian & Indian seas & the more remote East is probable, seeing that he executed the only circumnavigation of Africa executed in ancient times. Beyond doubt, this was the thought of Darius i, lord of Persia as well as of Egypt. He completed the canal, but as his memorial stones, on the spot, mention he caused it to be filled up again, probably because his engineers feared that the waters of the Red Sea, admitted into the canal, would overflow the fields

The rivalry of the Lagids & the Seleucids was at the same time a rivalry between the Euphrates & the Nile. In the better time of the Lagids, the peaceful offensive was pursued with great energy. Not only was the canal, undertaken by Necho & Darius —

now called the Amnis Ptolemaeus - opened for the
first time by Ptolemy ii (c. 247 BC), but comprehen-
sive harbour structures were carried out at points
of the difficult east coast. Above all, this was done
at the mouth of the canal leading to the Nile, at
the townships of Arsinoe, Clysma, & Clysma
- all three in the region of the present Suez.

Augustus put in order the land and water routes & the
ports of Egypt. Kept, during the whole imperial period,
remained the rendezvous for the commerce of India
& Arabia, the routes Myos Hormos
& Berenice (on the Red Sea) being in the early
Roman period repaired by Roman soldiers. The
canal which connected the Red Sea with the Medi-
terranean remained navigable throughout the imperial
period, but was of secondary importance, being
chiefly used for the transport of blocks of marble
(sic) & porphyry. Trajan renewed & probably enlarged
it, joining it to the undivided Nile, near Babylon:
thus increasing its water-supply & calling it Trajan's
or the Emperor's River - Augustus Amnis - from
which in later times this part of Egypt was
called Augustamnica*.

* But of wandering

r B. Barbarus was in the Danube, not the Rhenus, arm of the Nile

IV Mr H. R. Hall in Murray's Handbook for Egypt: pp 49-51.

"There may have been a canal between the two seas in the time of Seti I. Probably Ramses II (Sesostris) carried out the idea of uniting them by means of the Pelusiac branch of the Nile from Avaris & Bubastis, by help of the irrigation canal between Bubastis & Heroopolis, which was then a port; the Red Sea then extending northwards as far as that of Heroopolis, including what are now the Bitter Lakes of the Suez Canal. Its length as given by Pliny was 62 M.P., which would bring it near to the present head of the Bitter Lakes. Darius continued the work of Necho, clearing out the natural channel - now silted up - between the Heroopolite Gulf & the Red Sea, this canal being about 10 miles long. Transit between the two seas was effected by ships sailing up the Pelusiac arm of the Nile to Bubastis, thence to Heroopolis, where cargoes were transhipped to Red Sea vessels. Ptolemy II restored the two old canals, joined the fresh-water canal with the Heroopolite Gulf, put in a lock & sluices between these sections, prevented the intermingling of the salt with the fresh water, also averting the former transhipment of cargoes at Heroopolis. The Amnis Trajanus may have been built by

Trajan or Hadrian & seems to have been the N canal which now leaves the Nile near Old Cairo, joining the older canal of the Bitter Lakes. If the canal ascribed to Trajan may have been the work of Amru (639), done at the bidding of the Caliph Omar to relieve the famine then raging in Mecca & Medina.[3]

N.B. i Rozière's identification of places goes back upon the views of Jomard & d'Anville, almost entirely.

ii Lepsius, the an independent observer, who spent several years in Egypt, is here greatly indebted to Rozière.

iii Mommsen largely follows Lepsius

iv Hall's account has very distinct affinities with the views of J. Lieblein, in his Handel und Schiffahrt auf dem Rothen Meere in alten Zeiten (1886). Space does not allow full reproduction of Lieblein's views

To show the extraordinary state of confusion into which this subject has fallen we subjoin a brief synopsis of the foregoing & other modern authorities: —

(7) N. B. "Wilkinson" revised & Birch: Anc. Egyptians: i. 47. 48 (1878)

(12) N. B. Couples this with earlier & earliest canal Lore & Amenemhat iii of the 12th dynasty

(14) Brugsch's History of Egypt revised & Miss Broderick (1891)

Brugsch's view was endorsed & Robiou, Lenormant, &c:

Diverse views of "Canal of Seti I" :-

1 D'Anville. —
2 Rozière. —
3 Letronne. —
4 Lepsius. —
5 Duncker. —
6 Ebers: Confounds the Pelusiac arm of the Nile with the canal*
7 Sir J. G. Wilkinson —
8 Rawlinson: Seti I is thought to have commenced canal from Nile to Suez
9 Sir William Mure. —
10 Wiedemann: Commits mistake of Ebers.
11 Mommsen: Apparently an older structure by Seti I
12 Lieblein: Seti I takes the canal up to the Bitter Lakes
13 Ménant: Commits mistake of Ebers: supposes neck of land Egypt
14 (Brugsch): Canal attempted by Seti I. (unrest between Nile & Serapeum
15 Erman: In old times a canal thro' the Wadi Tum. & Bitter Lakes.
16 Sayce: Seti I makes a canal from the Nile to Suez.
17 Harper: Commits mistake of Ebers
18 Gregorovius. —
19 Wm Max Müller. —
20 Budge: Some part of the (Wadi Tum) canal seems to have existed in
21 Hall: Endorses (?) the mistake of Ebers. (Seti's time

* Brugsch is only the author of this view which makes the canalised arm of the Nile at Zakazik - "Seti's canal" Cf p.

(3) cf Recueil. vol i pp 136-197 (1842): [also Revue des deux Mondes ~~XXVII~~ [1841] pp 215-235]

(9) In Weir's revised version of Sir Wm Muir's Caliphate p 164: the canal referred to in Herodot. ii cp 158 is said to have existed under Romans ii.

14 Brugsch's History of Egypt by Miss Bedrick (1891): version of first edition by Brugsch himself

ii Diverse views of the canal of Ramses ii (Sesostris): –

1 D'Anville. –
2 Ruzière. Sesostris takes the canal up to the Bitter Lakes only.
3 Lefronne. Sesostris commences a canal: ceases for fear of the Red Sea.
4 Lepsius: R. ii digs canal from Nile to Heroopolis (= Magfar).
5 Duncker: R. ii digs canal from Bubastis to the Crocodile Lake (Timsah)
6 Ellis: A canal enacted in time of R ii thro. Wadi Tumilat as shown by
7 Sir J. G. Wilkinson: Sesostris is thought to have cut (his monuments there
8 Rawlinson: Canal thro Wadi Tum. mainly (a canal from the Nile to Suez.
9 Sir Wm Muir. – (the work of R ii: locks & sluices.
10 Wiedemann: Canal between L Timsah & R.C. in time of R. ii.
11 Mommsen: Apparently an older structure of (Seti i and) R ii.
12 Lieblein: R ii deepens Seti's canal: does not extend it beyond Bitter
13 Ménant: Canal via W. Tum. to Red Sea before R ii's (Lakes time.
14 (Brugsch): Canal attempted by R ii, as by Seti i.
15 Erman: Continued the old canal: cutting from Bitter Lakes to
16 Sayce: Existence of canal as under Seti i. (the Red Sea (Suez)
17 Maspero: Canal of Seti lasted to XX^th dynasty, then silted.
18 Gregorovius. –
19 Wm Max Müller: R. ii continued canal from Nile to Bitter Lakes.
20 Budge: R. ii intended to lengthen Seti's canal to Red Sea
21 Hall: R ii possibly carried out the idea of uniting the
two seas by way of the Wadi Tumilat.

(3) N. B. L. Nemks Necho, now in contact with the Greeks, made
the attempt in imitation of the attempt of Periander & pierce
the isthmus of Corinth for a canal (625-585 BC)

(9) Herr makes Necho attempt to continue the old canal to the Red Sea (l.c.)
(10) Route of the 4 Wade Journal, and Bitter Lakes to Suez

(13) Bitter Lakes not yet formed as separate from the Red Sea,
which is supposed still to reach to the Serapeum.
(16) Cf "Egypt of the Hebrews" p 125

iii Diverse views of the Canal of Necho:-

1 d'Anville: N. first to build a canal between Nile & Red Sea: incomplete
2 Rozière: N. takes canal of Sesostris: stops at Bitter Lakes.
3 Letronne: N. first to attempt to join the two seas by Nile canal.
4 Lepsius: N. appears to have led the canal to Bitter Lakes: stops there
5 Duncker: N. takes R ii's canal to Bitter Lakes: stops there
6 Ebers: N. undertakes canal between Nile & Red Sea: stops short
7 Sir J. G. Wilkinson: Some say N. cut canal to Suez: possibly reopened that
8 Rawlinson: N. re-opens communication of R C with B. Es (Felusiac bra.
9 Sir Wm Muir: N. first to attempt canal between Babastis &c
10 Wiedemann: N. determines to join the two seas: fails (R.C. (Suez))
11 Mommsen: N. begins canal from near Cairo to Suez: incomplete
12 Lieblein: N. deepens silted Sesostris canal: stops at Bitter Lakes.
13 Menant: Conf N. realised the canal: stops at Serapeum (near B. Es).
14 (Brugsch): N. attempts reconstruction of old canal to Suez: fails.
15 Erman: N. re-opens R ii's silted canal (to Red Sea)
16 Sayce: N. partly clears out old canal from Nile to Suez.
17 Maspero: N. re-[illegible] canal of Sesostris, carries it to Lake Timsah
18 Gregorevius: N. completes canal from Nile to Red Sea by Serapeum
19 Wm Max Müller: N. completes canal from Nile to Red Sea (made Pharaoh)
20 Budge: Necho carried R ii's canal to Red Sea from Bubastis (Etc?)
21 Hall: Necho's canal from Nile near Bubastis to Serapeum.

(5) Cf/pert read "destruction" of this canal by Darius himself into the hieroglyphic text. Cf p

(11) Mommsen accepts mistaken view of Cf/pert, ut supra
(12) Darius did not cut this narrow neck of land between the Wadi Tumilat Canal & the head of the Bitter Lakes, but deepened the natural channel of the Heroopolite Gulf (of a later day) up to the Suez creek (Lieblein)

Darius leaves uncut the narrow neck of land between the Wadi Tumilat Canal & the 3 Bitter Lakes. Thus perpetuating the need of transhipment of cargoes at this point

IV Diverse views of the Canal of Darius I:—

1 d'Anville: Communication between Nile & Red Sea not till time of Ptolemy
2 Rozière: D. proceeds with Necho's canal till stopped by the Red Sea (ii
3 Letronne: D. repeats Necho's work: carries it to Red Sea (Suez:).
4 Lepsius: D. completes canal to Red Sea by cutting the sill of Chalouf &
5 Duncker: Accepts completion, like Lepsius: rejects Lesseps's view (Suez.
6 Ebers: D. completes the canal near Suez: proved by monuments.
7 Sir J. G. Wilkinson: Some leave completed by Darius: promptly reopened
8 Rawlinson: D. reopens communication between Bitter Lakes & Red Sea (old canal
9 Sir Wm Muir: D. opens communication between Balastis & (Suez).
10 Wiedemann: D. continues work of Necho: death stops (Red) Sea (Suez
11 Mommsen: D. completes canal, then fills it up (achievement.
12 Lieblein: D. deepens Necho's canal to the Bitter Lakes & Chalouf
13 Ménant: D. had to cut thro' sill of Chalouf: completes (section not
14 (Burgsch): D. completes canal to near Suez: on line of Stelae: opposed
15 Erman: D. reopens old canal of (Rii?) Necho, now silted: up to Red (discussed
16 Sayce: D. re-opens old Pharonic canal up to Suez. (Sea.
17 Maspero: Darius completes her canal according to Herodt. ii. 158.
18 Gregorovius: D. repairs canal of Necho: does not take to Red Sea.
19 Wm Max Müller: D repairs canal of Necho up to the Red Sea (Suez).
20 Budge: D. carried Necho's canal finally to the Red Sea (Suez?)
21 Hall: D. continues Necho's canal: clears out channel
now silted between Bitter Lakes & Red Sea (Suez):
(clears out & uncovers the neck of land between Wadi Tumilat Canal & the Bitter
Lakes: so as to permit passage of former transhipment of cargoes here)

Cf vars

(9) N.B. This origin of the canal is shown hereafter to require the water to run uphill. Cf p 61

(12) Part ii thus makes a continuous waterway between the Nile & the Red sea by cutting this neck of land between the Fresh-water canal of the Wadi Tumilat & the salt-water of the Bitter Lakes. In the sequel this is shown to be quite imaginary. Cf p 129

V Diverse views of the canal of Ptolemy ii :-

1 D'Anville : Ptolemy ii achieves the connection between the Nile & the Red
2 Rozière : Ptolemy ii completes old canals up to Suez. Sea (Suez)
3 Letronne : Ptolemy ii re-establishes the silted canal of Darius (Suez)
4 Lepsius : Ptolemy ii digs the Amnis Ptolemaeus to Suez region.
5 Duncker : Ptolemy ii digs the Amnis Ptolemaeus to Suez region.
6 Ebers. —
7 Sir J. G. Wilkinson : Some leave completion of old Pharonic canal to Ptol ii :
8 Rawlinson : Ptolemy i reopens canal of Darius. (conceivably re-opened in
9 Sir Wm Muir : Ptolemy ii digs a second canal from Pithom to Red Sea
10 Wiedemann : — (Suez)
11 Mommsen : Ptolemy ii completes the old canal of Neco & Darius up to Suez
12 Sieblein : Ptol. ii cuts the sill of Kelalouf : clears out old canals, makes
13 Ménant : Ptol ii clears out the old canal of Darius (and south : lets Nile into Bitter Lakes
14 (Brugsch). — ↳ from the Serapeum to Suez
15 Erman. —
16 Sayce : Ptolemy ii clears out the old Pharonic canal to Suez
17 Maspero. —
18 Gregoroviius : Ptolemy ii completes the canal of Darius up to the Red Sea.
19 Wm Max Müller : Ptolemy ii repairs canal of Darius to the Red Sea
20 Budge. —
21 Hall : Ptolemy ii does all that Sieblein ut supra alleges :

2 The communication opened during the reigns of Trajan & Hadrian was not the old canal of the Lagids (Ptolemies)

3 Trajan added 60 kilometres to the old canal = Bubastis to Babylon

9 Trajans canal navigable till end of third century

19 Possibly in use until the time of Septimius Severus

VI Diverse views of Trajan's Canal:-

1 D'Anville. —
2 Rozière: The communication between the Nile & Heroopolis was new
3 Lefronne: The Ptolemaic canal was navigable in Nero's time: Trajan's
4 Lepsius: Trajan canal, ut supra, was new. (canal was new
5 Duncker: Trajan opens a new canal, ut supra, between Babylon &
6 Ellis. — (Heroopolis
7 Sir J. G. Wilkinson: After the Arabs & the Caesars, Caliphs reopen the old
8 Rawlinson: Trajan reopens line between B. Ls & R.C. [(Trajanic) canal.
9 Sir Wm Muir: Trajan deepens one of the lines of the old canals (to Suez)
10 Wiedemann. —
11 Mommsen: Trajan renews the old imperial canal (to Suez).
12 Sieglin: Trajan repeats the Ptolemaic canal.
13 Ménant: Trajan clears out the Ptolemaic canal, silted in
14 (Brugsch). — (Cleopatra's time.
15 Erman: Trajan and Hadrian re-open the old canal.
16 Sayce: Trajan clears out the old Pharaonic canal.
17 Maspero. —
18 Greyrowers: Trajan restores Ptolemy's canal.
19 Wm Max Müller: Trajan repairs the old canal to the sea (Suez).
20 Budge. —
21 Hall: Trajan (or Hadrian) cuts new canal from Babylon. This
seems to have been the old canal which now leaves the Nile
near old Cairo.

VII Diverse views of Omar's Canal:-

1 D'Anville. -
2 Rozière -
3 Lehonne -
4 Lepsius: Omar re-opens the uninterrupted communication between the
5 Duncker: Omar reopens communication as above (Two seas.
6 Ebers. -
7 Sir J. S. Wilkinsons: Caliphs re-open the Ptolemaic Canal.
8 Rawlinson: Omar re-opens the communication between Bitter
9 Sir Wm Hunt: Amru cleans out Trajan's Canal Lakes & Red Sea
10 Wredemann. -
11 Mommsen. -
12 Lieblein. -
13 Ménant. -
14 (Brugsch). -
15 Erman: Amru made Trajan's Canal navigable for some time
16 Sayce: Amru clears out Trajan's Canal
17 Maspéro. -
18 Gregorovius. -
19 Wm Max Müller -
20 Budge. -
21 Hall: Omar makes a new canal from Old Cairo to Suez

Conclusions regarding the views of Modern Authorities

(1) There are more than a hundred divergent views, readily incapable of being reduced to any moderate number of classes. No other problem in Egyptology comes near this in point of diversity of view.

(2) All these views, however, agree in one point, viz: That there was no natural connection in historical times between the Nile & the Red Sea. Such connections were always artificial

(3) Writers sometimes suppose the existence of but one canal as necessary to join the Nile & the Red Sea: sometimes of two canals, cut at different times & different parties

(4) Writers sometimes think of the Red Sea as extending beyond Suez up to the head of the Bitter Lakes: sometimes of it as extending only to the region of Suez

(5) The literary sources have been found, as above, to be incapable of solving the problem presented of these ancient canals. The object of this research is to utilize the literary sources, old & new, classical & monumental, in conjunction with the Sciences of Geology, Geography, & Engineering, to attain some more reasonable results than the foregoing.

Verified by Linant in 1847 & by the international Commission of Engineers in 1848. These were Negrelli (Austrian), Talabot (French) & R Stephenson, son of the inventor of the locomotive engine. Negrelli left his work & his assistants. Linant re-verified his results in 1853 & 1856

(6) Has led to novel & quite definite results, showing that these ancient canals, associated with the joining up of the Mediterranean & the Red Sea, were four in number:- i The trade Tumilat canal: ii The Heliopolite Canal: iii The Northern Canal: iv The Southern Canal. Cf pp 19. 20.

— " —

The Geological Problem

Interest in the Geology of Egypt had its origin in the proposal of Napoleon I to join the Mediterranean & the Red Sea by a ship canal. Having appointed Lepère surveyor, he himself on the last day of the year 1799 traversed the proposed route of the canal from Suez to Belbeis. Lepère's survey, which brought out a difference of level between the two seas, amounting to more than 30 ft (9m 9cms 7mm) arrested the project, the Laplace & Fourier, both most eminent mathematicians, contested the correctness of Lepère's figures. Not till 1841 were these corrected by Linant (Bey), & not till 1859 was the excavation of the Suez Canal begun. The interval between 1799 and 1859 was marked by considerable diligence in studying the geology of the Isthmus of Suez. Here may be mentioned the names of Du Bois Aymé, Lepère, Rozière, Laurent, Renaud, Carter,

Buist, Captain Newbold, Wilkinson, Lepsius, Salah Sf, R Stephenson, Mrs Corbeaux, Lenepsi & many others. Their theories are of little consequence now, but their records of facts of observation are important & are included in this review. Among recent works of first rank must be mentioned those of Prof. Suess, Sir J. W. Dawson, & Prof Hull; and very specially the reports & memoirs of the Egyptian Survey Department, along with Prof. Gregory's work - The Great Rift Valley. The relevant portions of this large body of literature are set forth & correlated in the sequel. As the scope of our subject is limited to points concerning the Nile in relation to the Mediterranean and the Red Sea, we need not go further back than the Tertiary Period of Geology:-

I. The Oligocene & Miocene Periods:
Transgression of the Mediterranean into the region of the Red Sea

Here we have reference to the region of the Gulf of Sinai with its corresponding ranges of hills on either side. Mr J. Barron, in his memoir on the Topography & Geology of the Peninsula of Sinai - Western Portion - (1907), points out that with the exception of a few patches of Upper Eocene on the Sinai side & one small piece of Oligocene at the Wadi Tayiba, the foregoing area was a land surface prior to Miocene times. At the close of the Oligocene period or during Lower

Miocene times, when denudation seems to have been most active, there was a subsidence of the whole area comprised under the Isthmus of Suez, the district between Cairo & Suez along a line joining Jebel Surra & Jebel Ataka; also the district between Jebel Ataka & the northern Gallala (Kalalla?) range & the region extending from the foot of the present Red Sea hills & the plateau of El Tih in Sinai, as far south as the latitude of Abu Shar (c 28°.s). Into this region depressed came the waters of the Mediterranean Sea & the deposition of the Middle Miocene strata was begun. The Mediterranean had thus invaded the Red Sea area; but the Red Sea itself was not yet in existence. This transgression of the Mediterranean into the region of the Red Sea is proved by the Miocene fauna of Suez having affinities with ~~that~~ of the Miocene fauna of the Mediterranean & none with that of the Red Sea (Indian Ocean): thus proving that the Red Sea itself was not yet in being; for, had it existed contemporaneously, an ~~inter~~ intermingling of Mediterranean & Red Sea (Indian Ocean) species would have been inevitable. Cf L.c. p181. This transgression of the Mediterranean into the Red Sea region belongs to the Second Mediterranean Stage of Suess. Cf Suess i. 324. 379

II. The Pliocene Period:

Formation of the Great Rift Valleys of the Nile & the Red Sea: Confluence of the two seas in the great Bay of Lower Egypt.

The close of the Miocene period was marked by land elevation: this being continued into Pliocene times & issuing in great Rift-Movements in the crust of the earth, caused by tangential contraction therein, productive of lines of fracture, with subsidence of the rifted area from above downwards - cf Suess IV. 281 The next result is a trench-subsidence (grabenversenkung) - or Rift Fault. Rift movements & rift valleys are discussed by Messrs Barron & Hume in the Topography & Geology of the Eastern Desert of Egypt: Central Portion (1902). They are more elaborately discussed by Suess cf IV. 268-286. The two with which we are now concerned are those of the Nile & the Red Sea, both have been studied by Blanckenhorn, who holds that all the evidence at hand makes it fairly certain that none of the greater Rift Movements existed before the the Miocene period & fixes the two under consideration in the Middle Pliocene period. cf Op. cit. pp 158. 214. Beadnell, however, with fuller knowledge & after detailed examination sets them down to the Lower or the Middle Miocene period cf Op. cit. p 159

* Still a somewhat elusive phrase

Spatha Chazicana of the Nile

The Rift Valley of the Nile

This is traceable from the Mediterranean along the course of the Nile up to Esna, at least, some 650 miles above the Mediterranean. According to Blanckenhorn, this newly formed rift-valley was invaded by the sea: the invading sea being the Mediterranean at the Third Mediterranean Stage of Suess. Cf. op. cit. 158. 214. This marine invasion or transgression was of short duration. Gradual elevation of land followed, producing here a chain of brackish lakes, which latterly became emfluent: thus allowing the formation of the River Nile & the carving out of its channel northwards. Blanckenhorn fixes the date at the middle of the Diluvial period,* whilst Beadnell prefers the later Pluvicene cf. op. cit. 158. 159. There is little to choose between these dates; & Issel holds that the Nile, during the Pluvcene period, entered the "Arabic depression" alias the Jordan-Arabah section of the Great Rift valley (of the Red Sea). Cf. op. cit. 158: also Suess IV. 280. Sir J. W. Dawson might be claimed in support of this view - cf Science p. 215 Bauermann's discovery of Spatha Chazlana in the alluvial land of Ghennel, at the mouth of Wadi Magarah in Western Sinai, might also be cited in support of the foregoing - cf Suess 1. 384. These cases need not be further discussed, as they are decisively

set aside as confirmation of Issel's view, & the demonstration of Prof. Gregory that the fauna of the Lower Nile is conspicuous & its absence in the "Arabic depression" or Wadi-Arabah depression, whereas their presence there is required & Issel's view. cf Prof. Gregory: Great Rift Valley 255.256.

On the other hand, it is regarded as certain that, in Pliocene times, the Levant was a land surface, over which roamed such characteristic African fauna as the hippopotamus, the rhinoceros & the crocodile: their remains being found in Samos & Crete, whilst the crocodile survived in the island of Rhodes until at least the first half of the 14th century, as attested & the encounter of the knight Deodat von Gozen, with a reptile of this class. Crocodiles are also, still, found in the Crocodile River, near Caesarea. Prof. Gregory regards it as practically certain that the Nile must have been continued further northward & westward than its present mouth, during the Pliocene period. cf Gregory: Grt Rift Valley pp252. 253: also Suess i p 385.

The Great Rift Valley of Central Africa &c.

The title — Great Rift Valley — is a convenient one, tho' the area to which it is here applied is much greater than that described & Prof. Gregory in the work thus called.

The Great Rift valley has been traced by Blanckenhorn from Lake Nyassa up to the Taurus Mountains, over more than 52 degrees of latitude. It comprises the great lakes of Central Africa, the depressed area of North Abyssinia, the Red Sea, the Gulf of Akaba, the valley of Coele-Syria, up to the Taurus Mountains.

In the Pliocene period, the Jordan-Arabah section was filled with a large fresh-water lake, as shown by the terraces of the Jordan & the Dead Sea areas. Prof. Gregory contests the view of Prof. Hull that this lake found outlet into the Mediterranean & proves his point by showing that the Mediterranean fish fauna is absent from the Jordan-Arabah basin. He shows further that the foregoing lake found outlet by a river flowing southward from Palestine along the Red Sea section of the Great Rift valley, falling into the Indian Ocean, somewhere near Aden. This river, he calls suggestively — "the Erythraean River". He holds that it was probably united with another river from the highlands of Central Africa, flowing along the African part of the Great Rift valley from the northern end of Lake Rudolf — along the course of the rivers Omo & Hawash, thence across the Basin of Afar, to join at last "the Erythraean River". This water-system of the two rivers & their lakes, accounts for the fish-fauna which are common to the Sea of Tiberias & the Lakes of Central Africa: i.e.

† N.B. The point at which the Nile was said to join the Red Sea was near the Isle of the Serpents King, which is the Ophiodes of Agatharchides, Artemidorus, & Strabo: the Nekron of Pliny, & the Agathonis of Ptolemy.

common to the Jordan & the regions of the Upper Nile: the Nile valley below these regions formed a separate water-system, ultimately falling into the Mediterran[illegible] to the north-west of its present outlet. cf Gt Rift Valley: 255-260

A curious confirmation of a river flowing from central Africa into the region of the Red Sea, as above, may be found in the belief prevalent among the Egyptians of the 12th dynasty (2000-1788 BC) that the Nile thus flowed into the Red Sea in the region of the Holy Land of Punt - which region at this era meant, in a general way, the district between Suakim & Massowah. cf Maspero: Struggle: p 247.

Confluence of the Mediterranean & the Red Sea in the great Bay of Lower Egypt.

The transgression of the Mediterranean into the Red Sea region in the Miocene period (pp 37.38) was followed by one of elevation, in process of which the strata of the region under consideration suffered rupture along the edges of what is now the igneous & sedimentary ranges of the Red Sea hills & the Sinaitic Peninsula. Thus were formed at length the Isthmus & the Gulf of Suez towards the close of the Upper Miocene period.

But, as part of the cosmic movement of this era, sub-

N.B. Issel makes the Red Sea post-Pliocene. Hume accepts this of the invasion but thought it began in the Pliocene period

sidence followed, involving not only the areas named above, but also adjacent regions, including the lower reaches of the Nile & the Red Sea section of the Great Rift Valley. The Indian Ocean entered the latter upon formation of the Straits of Babel Mandeb. The "Erythraean River" then became the Red Sea, towards the close of the Pliocene period or near the beginning of the Pleistocene.* The newly formed Red Sea & the Mediterranean became confluent; & their confluence ~~flow~~ confluence] invaded the adjacent stretch of the Nile. The Red Sea & the Mediterranean became confluent; & their confluence formed the great Bay of Lower Egypt. *cf Barron: Topography & Geology of the Peninsula of Sinai: Western Portion (1907): pp 180-182. Prof Gregory: Int. Rift valley: pp 255-259: Prof. Hull: Survey of Western Palestine: pp 70-71.

The proofs of this confluence of the two seas is found in three notable raised beaches, whose approximate elevation is 200 ft above present sea-level: i That of the pyramid plateau of Giza on the western side of the Nile: ii Its counterpart on the Mokattam hill on the eastern side of the Nile: iii Traces of an ancient sea-beach described by Prof. Hull on the eastern margin of the Gulf of Suez, near Suez. The fossil contents of these beds cannot be here described. It is enough to note that the centre of interest here is

* NB. So-called, because they contain remains of Calypteaster Aegyptiacus

is "the Cheyne sands" * of the Siza beds, two miles south of the Sphinx. These contain remains of Ostrea Forskali & Pecten Erythraeus – forms which now live in the Red Sea and which by their fossil remains at Siza, as above, prove the intermingling of the waters of the Red Sea & the Mediterranean in this Bay of Lower Egypt. Cf Hull: Survey of Western Palestine: Jul 1097 pp 70. 71. * Suess i. 380: Dawson: Scenes: 215-218. Very different dates have been assigned for this intermingling of the two seas by Frass, Schweinfurth, Sir J. W. Dawson, Prof. Hull & others. Neumayr, followed by Blanckenhorn, sets it down to Middle Pliocene times by Barron & Hume: Topography & Geology of Eastern Desert of Egypt: Central Portion (1902): p 214. But the dominating factor here is the formation of the Isthmus & Bay of Suez. Barron, as noted, (p 43) assigned it to the close of the Upper Pliocene period. On that view, one may date the age of the Siza & Mokattam beds & therewith the intermingling of the two seas here, as towards the close of the Pliocene period or the beginning of the Pleistocene. Thus last, Prof. Gregory accepts. St. Rift valley: p. 251

* The contents of the Siza & Mokattam beds, are Hull as above: (a) bivalve molluscs, scallop shells, oysters, &c: (b) Echinoderms, scallop shells, oysters &c

† the Pliocene being the first Continental period.

In these borings see Proceedings of the Royal Society:
No. 39: p 213 &c. No 61: p. 62 &c.

III The Pleistocene & Post-pleistocene Periods: Formation of the Delta of Lower Egypt and diversion of the Nile in whole or in part to the Red Sea.

The subsidence of the land which gave origin to the Bay of Lower Egypt was very considerable. Sir J. W. Dawson, judging by the terrace of sea-caves on the Mokattam hill, reckoned it at 500 ft. or more. Cf. Science p 216 With the retreat of the ice-cap in the Northern Hemisphere, the land began to rise: thus introducing the Post-glacial age, often called the Second Continental Period[x]. Lower Egypt shared in this elevation of the land and entered upon its Fluvial Period. Denudation proceeded apace on the emergent surfaces of the land; the eroded materials helping to fill up the Bay of Lower Egypt. The borings in the Delta conducted by Figari Bey, Horner, Colonel Ardagh, & others have revealed a thick series of sands, gravels, & lenticular masses of stiff clay underlying the Nile alluvium & partly intermingled therewith. The thickness of this alluvial deposit varies greatly, showing that it has been deposited on an uneven bottom, consisting of sands, gravels, & clays as above. The borings conducted by Prof. Judd, specially at Tantah in the centre of the Delta, showed that the quartzose sands of these borings were really desert-

blown sands. From this it has been inferred that the Bay of Lower Egypt had become blocked by eroded material & desert sand; the Bay thus itself becoming a desert & obstructing the Nile in its northward course, causing it to turn eastwards, by what is now the wadi Tumilat into the Red Sea
cf Dawson: Science p 218

Proofs that the Nile did flow eastwards into the Red Sea, as above, during the Post-pleistocene period.

(1) The vast deposits of Nile mud in the Wadi Tumilat. These are continuous in character & deposition with those of the Delta. The two sets of deposits have grown pari passu, so that the Wadi Tumilat is to all intents & purposes an offshoot from the Delta.

(2) The existence of fresh-water beds around Lake Timsah, as discovered by Schweinfurth. These contain Nile shells, one species of which - Aetheria Caillaudi - is now confined to the ~~Delta~~ Nile above Aswan: also bones of hippopotami, crocodiles, & Nile fishes. The adjacent ridges of El Guisr & the Serapeum also contain Nile deposits. cf Dawson: Science pp 279-281

In (a) see Jo. of Bombay Asiatic Society viii. (1846) p 355
In (b) see Mem Corbeaux: Athenaeum (1851) p 684
In (c) see Lucas i. 382
N.B. Stephenson found a few fluviatile shells near the mouth of the upper canal, near the Serapeum. He was a very careful & competent observer, tho' he gave his voice against the construction of a Suez Canal

(3) Traces of Nile mud & Nile shells in the Bitter Lakes, discovered, when these were desiccated basins, before the construction of the Suez Canal, by (a) Captain Newbold (1842), (b) Robert Stephenson in his official survey for the proposed canal (1848), (c) by Renaud in borings carried through the thick salt crust at the bottom of the foregoing lakes

(4) Regular beds of Aethiria semilunata & Spatha Nilotica, discovered by Vaillant at a few points south of Lake Timsah; also near the Serapeum & the Ichaloufs. Cf Suess i. 380. 382. These forms still live in the Nile above Aswan

(5) Nile deposits overlying the Miocene strata at Ichalouf. These contain the teeth of crocodiles, bones of hippopotami, and remains of other African quadrupeds Cf Baedeker: p 171.

From the foregoing it is now self-evident that the Nile in whole or in part once found an outlet into the Red Sea, via the wadi Tumilat, beginning in the early Post-pleistocene or early Modern Period

How long did the Nile, at least in part, continue to flow down the wadi Tumilat towards the Red Sea?

The average is 17 ft.

Authorities are unanimous in confining this efflux of the Nile to prehistoric times; but this is demonstrably a colossal error.

Continuance of a Nile-arm eastwards into the Red Sea from the present day until early Post-pleistocene times

i The Historical Evidence

(1) The Fresh-water Canal, which to-day flows thro' the wadi Tumilat & onwards to Suez, is essentially an effluent of the Nile. Its length, over this space, is 225 kilometres, having in its course 13 locks. Its "head" at its "off-take" in the Nile is some 10 metres & it reaches Ismailia some sixty metres above the level of the Suez Canal there, and arrives at its final lock at Suez some three metres above mean sea-level. It is thus seen to be a very vigorous effluent of the Nile into the Red Sea. Cf Sir Wm Willcocks: Egyptian Irrigation: Map 164a: p183 &c: also passim

(2) Before the construction of this Fresh-water Canal was begun (1858), Mehemet Ali, Viceroy of Egypt, attempted to drain off the excess waters of the Nile inundation in the wadi Tumilat to Lake Timsah & Balah, but failed. Cf Jackson: Irrigation Works: p 205. His

(Thursday laying off 9" embury)

* With the exception of the Northern & the Southern Canals: pp 19.220

predecessors had similarly tried, but in vain, to shut off the Nile inundation from the wadi Tumilat by three dykes across it at different parts. Cf. p

(3) Abu Salih, "the Armenian", writing in the 12th century testifies to the old canal of Omar as still navigable from the Nile up to As-Sadir, in the province of Sharkiah: this As-Sadir being in the region of Lake Timsah. Cf p.

(4) Al-Kindi, "the philosopher of the Arabs", speaks of the old canal of Omar as now defunct; yet the waters of the Nile inundation still percolated to the marshes of Kolzum (Clysma), in the region of Lake Timsah. Cf p.

(4) Omar's Canal, constructed c 623 A.D, was Trajan's canal, running thro' the wadi Tumilat up to Heroopolis, in the region of Lake Timsah. Cf p.

(5) St. Silvia of Aquitaine, returning from her pilgrimage to Sinai, found the Nile flowing past Pithom (= Heroopolis – Pars quaedam fluminis Nili ibi currit. Cf Bernard. St Silvia [38]. Cf. also p. The date is between 379 & 388 A.D.

(6) The canals of Necho[x] i, Darius[x] i, Ptolemy[x] ii, & Trajan – (in part)

NB * Reference is to the inhabitants of Ramsey-Town as ship-owners For Ramsey-Town as a garden-city, see p

all flowed thro' the Wadi Tumilat, that being simply canalizations of the Nile in this region. That of Ptolemy ii is called POTAMOS by Diodorus, and Amnis by Pliny. That of Trajan is called POTAMOS by Ptolemy & otherwise Amnis. The last finally becomes in the later imperial period Amnis Augustus or Royal Canal.

Raamses

(7) The town of Raamses built or re-built by Ramses ii in the Wadi Tumilat & excavated by Prof. Petrie recently at Tell el-Retabeh, was a sea-port town in the time of Ramses ii, as shown by the ~~poet~~ Egyptian scribe, Pentaeua, (Papyrus Anastasi iii). His description of the place & people is too long & quote in full, but three sentences are decisive:- (1) "Their sea-ships enter the harbour." (2) "Those who dwell near the sea come with fish" (3) "There was beer from Khati (Sahara) in the harbour" Cf Brugsch (Brudsch): Egypt under the Pharaohs: pp 13-76. Prof. Breasted emphasizes this connection of Ramses-town with the sea or seas, close at hand; most evidently the Red Sea as extending to the eastern mouth of the Wadi Tumilat or further up the valley.

(8) During the XVIII th dynasty, Queen Hatshepsut (c 1500 BC) sends out a fleet of five ships to

* N. B. Josthmes iii, shortly after this, returning from his eighth campaign in Syria finds his fleet returned from Punt, awaiting his return at Thebes in October - reason of the inundation Ancient Records of Egypt ii §486 p. 204

192

* N.B. Darius in the first place & Ptolemy Philadelphus in the second had to make such a change of ports, evidently for the same reason

"the Divine Land" – & Punt. These ships, as depicted on the reliefs of the Der el-Bahari Temple at Thebes, are one & the same whether represented on the Nile or on the Red Sea. There is no mention or suggestion of transfer of cargo from the Nile & the Red Sea or vice versa. The clear inference is that the fleet has had a continuous voyage both ways; & the only route for such a continuous voyage must have been by the Wadi Jumdat, at or about the time of the inundation: thus implying an abundant effluent of the Nile & the Red Sea. cf Breasted: [History of Egypt: p] Ancient Records: ii

(9) The cessation of this eastern arm of the Nile in the time of Ramses iii of the XX th dynasty (1198–1167 BC) must not be inferred from the fact that his fleet of ships to Punt is fitted out & returns to a point on the Red Sea opposite Copt on the Nile. This change in the port of departure & return is more easily explained by the perils involved in navigating the northern part of the Red Sea where heavy north winds prevail for most of the year or of the perils to vessels proceeding via the Wadi Jumdat on account of the Syrian League against Ramses iii, or by both sets of circumstances

(10) The discoveries of Prof. Petrie at Tell el-Retabeh – the site of Ramses-Aroun ( ) prove occupation of the Wadi Jumdat by soldiery from the time of the

x Cf Stone vases of the Old Kingdom &c.

N.B. The occupation of the Wadi Sumdat & Bedouin herdsmen is attested for the XII.th dynasty & the story of Sinuhet, the fugitive prince: Cf. p.

N.B. Its deposits fairly uniform in thickness tapering off northwards on a line between Cairo & Zagazig, see Captain Lyons: The Nile: p 339 f: viz Kasr el Nil, Qalioub & Zagazig

N.B. The memoir of the Egyptian Survey Dept. on the Soil & Water of the Wadi Sumilat (1903) was not obtainable, tho' Bruce expressly sent for to Cairo, nor was it otherwise available.

the XXIII rd dynasty backwards & the first six dynasties; & such occupation requires a water-supply, in this rainless region, best represented by an arm of the Nile flowing eastwards to the Red Sea. Cf Hyksos & Israelite Cities: pp 28-34. Cf also Duncan: Explanation of Egypt: pp 167-175

(iii) The existence of the fortification, called the Wall of the Prince, situated in the Wadi Tumilat (p) proves occupation military of this region as far back as the first four dynasties; requiring as a portulate an abundant water-supply, as an effluent of the Nile eastwards.

ii The Geological Evidence

(1) This is found in the great thickness of the Nile alluvium in the Wadi Tumilat. The deposits of it there are uniform with the adjacent deposits of the Delta, evincing no breach of continuity by faulting or otherwise. This uniformity of character & thickness, in these parts, indicates equality of age & leads back to the Post-pleistocene period; therefore to a pristine Nile and a pristine Nile-arm thro' the Wadi Tumilat

(2) Finally, there is some evidence that the slope of the Wadi Tumilat towards the Red Sea may once have been steeper than now, as there may have been

N.B This is apart from the peculiar movement north & south, which has as its axis [the Wadi Jumilat] El Guisr

Cf. Dawson: Science p 285. The elevation in the region of Suez is three metres since the time of Omar Cf Suez i. 382. The depression in the north going into Lake Menzaleh, & Lesyan, according to Makrizi and Masoudi, a century before the Arab conquest of Egypt (25 of the Coptic era = 535 A.D.) Cf Quatremere i. p 287 ff

secular elevation of the land along the eastern borders of Egypt in modern times. In proof one might point to the disappearance of the Pelusiac arm of the Nile, after 640 A.D. or thereby (Laurent), the shallowing of the Damietta and the deepening of the Rosetta branches of the Nile (Willcocks: Eg. Irrigation: p 33) Captain Lyons rather inclines to this view (The Nile: p 349). All that can be said at present is that, if such elevation has occurred, then the mouths of the rivers might be expected to become Nile effluents to the Red Sea to become, as we go further back in time.

Conclusion:- The current view becomes untenable, which asserts, in the words of Captain Lyons, that "the ancient Nile arm which deposited the Nile alluvium in the Wadi Tumilat as far as Ismailia" was "unknown as a natural channel in historic times" (The Nile: pp 348. 349. The foregoing evidence proves that the Nile, at least in part, has never ceased to flow down the Wadi Tumilat to the Red Sea from the early Pleistocene period until the present day.

N.B. Sicard - not Sicart, as with the Germans.

* notamment, les savants français de l'Expédition d'Égypte -

The Geographical Problem

Interest in the ancient Geography of Egypt precedes the French occupation of Egypt, 1798-1801. Excellent work had already been done upon it by d'Anville (1697-1782). He was a geographical genius, whose work, as a whole, has magnificently stood the test of time. His method was soundly scientific, being prefaced by a profound study of ancient measures & itineraries. In this respect, he owed much to his learned predecessors — N. Bergier (1567-1627) & Celaude Sicard S.J. (1627-1726), an accomplished scholar who travelled much in Egypt & the Levant. Amongst the experts who took part in the scientific work of the French Expedition, as above, were the eminent geographers — MM Gosselin & Larcher. These observers & others accepted almost without demur the identifications of d'Anville, whose health did not allow him to travel abroad: — "Pour ce dernier pays (l'Eg.) ont pu constater l'étonnante sagacité de ses (d'Anv.) inductions" (Larousse). But to d'Anville must be traced several fundamental errors, which still prevail, & the confusion of our subject. Here are noted in the sequel.

The literature of our research is overwhelmingly abundant. The classical geographers are often in evidence as we proceed, & need not be named here. The same may be said of the Arabic geographers & historians. Among modern

× whose names might be cited,

† Peutinger Map
Antonine Itinerary
Theodosian Tables

writers (see Table) enriched our subject, - and the names - Lepsius, Bunsen, De Bois Aymé, Langlès, Mannert, Ritter, Quatremère de Quincy, Laurent, Lesueur, Lehrmann, Champollion (le jne) Bunsen, Sir J. G. Wilkinson, Linant Bey, Weil, Lepsius, Chabas, Rawlinson, Duncker, Schlieben, Lieblein, Mariette Pasha, Brugsch Bey, Ebers, Lenormant, Ebers, Ermann, Dümichen, Forbiger, Sayce, Lieblein, Lublin, Langlès, M. Max Müller, Revue Archéologique, Mehlmann, Marcille, Petrie, Daressy, Lenormant, Rayet, Golenischeff, Gayet, Gardner, & many others, and space permits, the data furnished by these latter writers on Site & Lake-Inhabitance, being derived largely from Greek & Egyptian sources. The newest results have been constantly sought out, compared and correlated; thus permitting & requiring new conclusions to be formed on many points connected with our Geographical Problem.

Ancient Itinerary Measures

These require attention, as older identifications of Egyptian sites often depended upon them, & the mistakes of d'Anville & others have, in no small measure, been due to a natural but undue confidence in the figures furnished by the Peutinger Map, the Antonine Itinerary, Ptolemy's Geographia, & the Theodosian Tables. Modern

(1) Griffith: (2) Lyons: (3) Hultsch: (4) Griffith (Edfu):
(5) Griffith (Ar of Rai)

4 or 60 stades. The variations in the length of the stade must also be kept in view: -

(1) Attic stade = 606·9 ft.
(2) Olympic stade = 630·8 ft
(3) Roman stade = 607·0 ft
(4) Asiatic stade = 485·1 ft (Herodot. + Xenophon)

research still finds these documents indispensable, but now uses them with caution. Egyptologists are well agreed that an old Egyptian itinerary measure underlies the positions set forth in the foregoing work. This is variously called aa, ater, atru, atour. Cf Griffith Proc. of the Society of Bibl. Archaeology, XIV. 408 ff: XV. 305 ff: also Lyon: Cadastral Survey of Egypt (1908): also Prof Petrie: Naucratis. Pt. i. p 91 (1885): Hyksos pp 61-67 (1906), &c. The following values have been assigned to this ancient measure (1) Atru of Tell el Amarna: 10 stades [= 3600 Eg. cubits:] (2) 13 stades [= c 2000 m:] (3) 32 stades [= 6·3 kms] (4) 40 stades: (5) 70 stades. Following Brugsch, this old Egyptian measure is taken as the equivalent of the Greek ὄχοινος. (1) Herodotus reckons it as equal to two parasangs (ii. 6). This agrees fairly well with his estimate of the distance between Heliopolis and Thebes; but the ὄχοινος falls to about 30 stades (—) in his estimate of the length of the Egyptian littoral along the Mediterranean (ii. 6) (2) Xenophon reckons the ὄχοινος at 30 stades: (3) Eratosthenes at 40; (4) Pliny at 32, (5) Strabo at 30, 40, 40+, 60 & 120 (xvii. i. 24). Prof. Petrie in his critique of distances in the Geographia of Ptolemy makes the ὄχοινος approximate to 60 stades. Cf Naucratis. i p 91. In his critique of distances in the Antonine Itinerary, he takes 12 M.P. as the nominal equivalent of 2·5 ὄχοινοι; thus making

* NB. Where he takes the OXOIVOS as equal to 30,000/2·5 cubits, the OXOIVOS is c 30 stades.

* Her idea underlies the Persian farsakh & the Swiss stunde

the 6XVIVS approximate to 40 stades of Hykoos pp 66-67.
These results are not correlated with each other - four author. It is enough to note that localities fixed by itinerary measures must be treated with a certain degree of caution as to their correctness of position.
As regards latitudes & longitudes in the Geographia of Ptolemy, we can only note that he gives scientific precision of form to data which are very unscientific - namely itineraries set forth for sea & land in terms of the days work*. He also fixes positions down by 1/2 the twelfth of a degree; & his degree represents 500 stadia, instead of the better figure of Eratosthenes - 600 stadia. Ptolemy's longitudes are thus erroneous & his latitudes are much more so.
Yet the geographical data of the Antonine Itinerary, the Geographia of Ptolemy, the Peutinger Map, & the Theodosian Tables, when applicable to any given case, in whole or part, yield very reliable results in the main

Sites of Places, &c

cf Mah p 139 ### 1 The Wadi Tumilat

This was a narrow valley which begins near Abu Hammad Station, some 58 miles NE of Cairo on the Cairo-to-Suez Rly [illegible] p 57 p 5

Y This doctrine lies entirely with our purview but is capable of being mathematically tested on the lines adopted by (Sir) G. Dawson. Cf Philosophical Transactions: Nov. 1876

Its length is about 30 miles; its breadth varies from 0·5–2·0 miles; its average width is about one mile. Its narrowest part is somewhat east of Raqel Wadi, where it is about half a mile broad. Through this valley flowed the Nile, at least in part, from the early Post-pleistocene period until the present day. It is the ancient Land of Goshen & still abounds in fertility. It was once broader & deeper, as the sands of the surrounding desert have filled all the ages been encroaching upon it. At the time of the French Expedition (1799) its southern margin was marked by sand dunes, some 40 & 50 ft high; its depth below the general surface of the surrounding desert was 20 & 30 ft. Traces of the old canal of Lemar were conspicuous at its western extremity at the time of the French survey (1799-1801). The Fresh-water Canal of D-day follows the old tracks, not my down the Wadi Tumilat, but even on the section between Ismailia & Suez (Lesseps). So decidedly is the terrain of this wadi an integral part of that of the Delta, that the rise of the former has kept pace with that of the latter. Suess [Sueß] repeatedly refers to this phenomenon under the cryptic phrase – "the stationary state of the Nile" (i. 381. 383. 384). This he associates with his doctrine of changes in the strand-lines. This common stability of the Delta in the region of the Wadi Tumilat with corresponding stability in the, [at least] the Wadi Tumilat itself,

* Sometimes - Ψακνύω

is of the utmost importance & our further research, as bearing upon the gradient of the Wadi Tumilat Canals of early times. Cf. p.

ii The site of Phacusa - Φακοῦσα.

This is of importance & us as the point of "off-take" (ἀρχή) of the Ptolemaic canal, according & Strabo. Cf. p. 15. Herodotus gives as "off-take" for the canals of Necho and Darius, Bubastis on the Sanitic Nile. Cf. p. 10. Prof. Naville, after excavations (1887), placed the site of Bubastis at Zagazig, some 4 & miles by rail from Cairo, towards the north-east of the Delta. The same authority, after excavations, (1884), located Phacusa at Saft-el-Henna, some Nine miles, east of Zagazig (cf Goshen). But the trouble is that this is not convincing & many even yet; & indeed the geographical evidence was by no means exhausted by Dr Naville. Many would still identify the Phacusa of Strabo with the modern Fakus, which is some 15 miles N.E. of Saft el Henna. Then other two places require & be dealt with: (1) the Phacusi of the Peutinger Map & the Theodosian Tables; doubtless the same as the Phagusae of the "Geographer of Ravenna"; (2) the Φακοῦσα of Ptolemy. The site of (1) is set down as 36 M.P. from Pelusium: that of (2) works out at some 26 M.P. upon Ptolemy's data: —

* Heroopolis. Long 63°·10′ Lat 30°·0′
Pelusium. Long 63°·15′ Lat 31°·15′
Head of Heroopolite Gulf. Long 63°30′ Lat 29°·50′

Cf Quatremère: i p 62. (Darabiah has 28 towns.)
Cf Makrizi in Mémoires de la Mission Archaeol. au Caire:
Vol XVII Ch 25, p 207

Pelusium Long. 63°-15' Lat 31°-15'
Phacusa Long. 63°-10 Lat 30°-50'

Now it can be shown from the relevant data of Ptolemy that his estimate of the breadth of the Isthmus works out at 80 M.P.; whereas the estimates of Herodotus, Strabo & Pliny work out at 125 M.P. The former figure is certainly too low, whilst the latter is fairly correct. Ptolemy's figures for this part of the Delta, therefore, require the raised by the factor 125/80; & when this is used, the preceding 26 M.P. becomes c 40 M.P.; which figures are sufficiently near to each other to make it fairly certain that the Phacusi of the foregoing Itineraria is also the Φακοῦσσα of Ptolemy. But the latter is too far down stream to be the "head" of any canal passing down the Wadi Tumilat. Dr. Naville's site for the Φακοῦσσα of Strabo is thus anew established; & entirely new corroboration of it is found in Makrizi, where among the towns of Sarabiah he mentions Fakous; for this Sarabiah (Hout) is the name of Arabia & this Fakous is clearly the Φακοῦσσα of Strabo. The latter is thus abreast of the ancient Bubastis, showing that the old canals of Necho & Darius drew both from the Sanitic & the Pelusiac arms of the Nile: ~~Such an~~ (Such) an

an arrangement being a common one in ancient & modern times.

iii The site of Arsinoe - Ἀρσινόη

This is of cardinal importance & our research as proving the outlet of the older canals in the region of Ismailia or in the region of Suez. This is one of the fundamental questions in the system of d'Anville. The city was founded by Ptolemy ii in honour of his recently deceased sister-& wife, Arsinoe c/p. The site has not yet been recovered by excavation, and it does not contribute to simplicity & know that this being founded 18 cities of this name, three of which, at least, belong to Egypt. Stephanus Byzantius knew of eleven (11) Arsinoes in his time (6th cent. AD) - the sixth is "ἐπὶ τοῦ Δέλτα"; the tenth is in the land of the Troglodytes. The chief point at issue here is the placing of Arsinoe at the eastern end of the trade route at a placing it on the Red Sea, by Suez. d'Anville is prime authority for the latter (Anc. Egypt ii. 165); he having identified the bitter lakes - πικραὶ ... λίμναι - of Strabo (xvii. 1. 25) with the Bitter Lakes, now forming part of the Suez canal; & having relied on Ptolemy's longitude & latitude for Arsinoe. Lepsius, Rozière, Goodwin, Larcher, followed suit. So did Rennell, Mannert, K Müller, Rawlinson, Lepsius, Mommsen, Donne, (Donne

Geographia IV ch V p 278 (Willberg)

Larousse, Sir Wm Muir, Menant, Suess, Sayce, Bunbury, Schoff, and a host of other writers scarcely less eminent. It seems an adventurous thing to dissent from the views of such a multitude of savants. Nevertheless it is easy to prove they are thoroughly mistaken. Ptolemy's data are these:- Heroopolis Long 63°.10 Lat 30°.0

Arsinoe Long 63°.20 Lat 29°.30

The latitude is the important element & has two other readings, viz 29°.20', also 29°.10' Cf Wilberg p 278: also Lepsius: Chronologie p 348. Heroopolis is now well known and its site is the central point for fixing adjacent sites. Its site was recovered by Prof Naville (1883) at Pithom & was again explored by Currelly in 1904. Pithom is in the Wadi Tumilat some 12 miles west of Ismailia & some 4.5 miles east of Nahasma on the Ismailian Railway. These three readings of Ptolemy would place Arsinoe some 30, 40, & 50 miles south of Heroopolis-Pithom. Many think that Ptolemy has confounded this Arsinoe with the well known Arsinoe of the Arsinoite nome (Fayoum) thus:

Arsinoe of the Arabian nome Long. 63°.20'. Lat 29.30.

Arsinoe of the Arsinoite nome Long. 61°.40'. Lat 29.50.

Such a mistake is quite possible, but it becomes certain that Ptolemy is useless here. When one knows elsewhere, the site of Arsinoe is no longer doubtful.-

Book iii ch 74

(1) Agathacleides, who was Autor D Ptolemy Soter (or his brother) II, writing when this Arsinoe was active, more than 250 years before Ptolemy the geographer, places this town in a low-lying district, with a marsh and an arm of the Nile near it. Ptolemy IV, 8 V in Müller: Geographi Graeci Minores: vol i. pp 166. 167

(2) Diodorus, who visited Egypt c 60 BC, & had good opportunity for knowing her, [~~places Arsinoe on the high land of persons~~] makes it a port of departure, marked by brine springs in its neighbourhood — Ἀπὸ Πολεμαΐδος τοίνυν Ἀρσινόης κομιζομένοις παρὰ τὴν ἐξῆς ἤπειρον ... Cf Müller, ut supra: Vol. i. p 167.

(3) Strabo, who visited Egypt in 24 BC, makes Arsinoe adjacent D Heroopolis & Cleopatris (XVII. i. 26). Indeed Arsinoe is sometimes called Cleopatris (XVII. i. 25): & Cleopatris is near the mouth of the old canal which leads from the Nile (XVI. iv. 23). There can be no doubt whatever, therefore, about this Arsinoe. Its site is near Heroopolis - Pithom in the eastern extremity of the Wadi Tumilat. It has nothing whatever D do with Suez.

(4) Pliny places Arsinoe on the Red Sea, 125 M P from Pelusium Cf Hist. Nat. V. 12. Now these 125 M P brings us exactly D the region of Heroopolis, for the breadth of the Isthmus is precisely 125 M P or

A* for the springs mentioned by them as adjoining Asinae:
these springs being in all probability the Fontes Amari
of Pliny. G. P.

the 1000 stades of Herodot. (ii. 158) & Strabo (xvii. i. 21; XVI. ii. 30; i. ii. 29).

(5) The Peutinger Map places Arsinoe at the head of the Sinus Arabicus at a distance from Babylon on the Nile, fairly corresponding to the distance between Pelusium & Phacusi (p 00), which is 36 M.P. That would place Arsinoe in the Wadi Tumilat, not far from Heroopolis-Pithom. [c 150-250 A.D.]

(6) Sicard, quoted by Gosselin, mentions the occurrence of warm brine springs at the eastern mouth of the Wadi Tumilat, in a site such as Agatharchides, Artemidorus (in Strabo) & Diodorus required. Cf Miller *ad* supra i. 167.

(7) [Naville] in an earlier edition of his "Pithom" pp 21.22 identified Arsinoe with Magfar, in the Wadi Tumilat, some three miles east of Heroopolis-Pithom. Maspero endorsed this view - cf Popular Stories: p 73. There is excellent reason in the preceding data for accepting precisely this site, tho' Naville himself has departed from it in his third edition of "Pithom", (p 27); preferring there to identify it with the Serapeum of the Antonine Itinerary, 18 M.P. from Heroopolis. But the preceding views (1) - (6) do not allow this identification. Magfar suits all the data; even those of the Pithom Stele (p); & Arsinoe may yet be unearthed on the site of this village of Magfar. In this connection one cites the report of the

† Cf Alav:- "Mougfar offre des ruines qui ont caractère d'un établissement public, qui on pourroit considérer comme ayant servi de douane, ou de poste pour la sûreté de la navigation. Cet établissement, qui est sur la rive nord du canal, a pu être considerable." Cf Description.. État Mod. I pp 39-40

engineers of the French Expedition, not hitherto cited in this regard: - Mongfâr (Magfar) - situé au nord et près des bords du canal (of the Wadi Tumilat), paroît avoir été un poste militaire ou une douane: on y trouve toutes les fondations d'un vaste bâtiment de forme carrée de 40 à 50 mètres de face, bâti en briques crues: les dispositions intérieures renferment des chambres à la manière des ogêls ou magasins des commerçans des villes d'Egypte - cf Description: État mod. i p 165.

The foregoing can hardly be other than the Arsinoe of the Pithom Stele (p 129); for its characteristic features are all here present - namely (1) a town near the mouth of Wadi Tumilat at its eastern extremity (2) a custom-house, a store-house, & a harbour: (3) the store-house, clearly like that unearthed by Naville at Pithom. In proof of these points we read in line 25 of the Pithom stele (p): "When he (Ptolemy ii) arrives, the chiefs bring him their tributes;... they gather their taxes in his storehouse of this harbour" (Arsinoe). One may therefore well believe that excavations on the site of Mongfar (Magfar) will be attended with sensational success

Naville thinks Arsinoe was not of long duration, but was replaced by Clysma, before the time of Con-

* Selech commits the common error of putting Arsinoë at Suez.

* NB the Arabic equivalents are Qulzoum & Kolzim, evidently corruptions of the Greek. Abu-Salih indeed uses the form Kolzum - a weaver's cord (= Greek Κάλωσια - a thread: Nayptionuth); but Abu-Salih was an Armenian, not an Arab. To couple the Arabic - Kolzim - (= destruction), as a place name with the destruction of Pharaoh's hosts at the Red Sea is rather trivial

stantine (Dillon p26.). This view, however, finds no support in history; for Arsinoe was, according to the Periplus of the Erythraean Sea, c 60 A.D., a place where stoles & cloaks were manufactured cf §§ 6.9. Again, in the Notitia Dignitatum of the fourth century, Arsinoe appears in mutilated form as — see, where was stationed — "ala octava Vandilorum" cf Seeck* p59 Finally d'Anville shows that the bishop of Celesphatus (= Arsinoe, according to Strabo), signs the Acts of the Robber Council of Ephesus in 449 A.D. cf Quatremère i. 171

IV The site of Clysma - Κλυσμα

This is a baffling problem but one of vital importance in relation to the extension of the Red Sea northwards beyond Suez in early times. The name is variously spelt - Κλυσμα, Κλεισμα, Πι-Κλυσμα, Celisma (Ant. Itin.), & Celesma (Silviae Peregrin.) There are also multiple forms - Κλυσμα Καστρον (Hierocles), & το Καστρον των Κλυσματος (Epiphanius). Κλυσμα denotes a sea-beach, & our difficulty is the location of this sea-beach - whether near Ismailia or near Suez or two places of the same name on these sites. Close study of the available data reveals two Clysmas - one in the north, another in the south. The existence of the latter has long been admitted: the existence of the former has

been much disputed; & not all the relevant evidence has been mustered hitherto.

The southern Clysma - near Suez.

(1) This is the Clisma of the Antonine Itinerary, 68 MP from Kew, which is Hieropolis. [c 230 A.D.?]

(2) This is the κλυσμα χρυσιον of Ptolemy. Its position relatively to the head of the Heroopolite Gulf being thus:-

Head of the Gulf	long 63°·30'	Lat 29°·50'
Clysma Promontorium	long 63°·20'	Lat 28°·30'

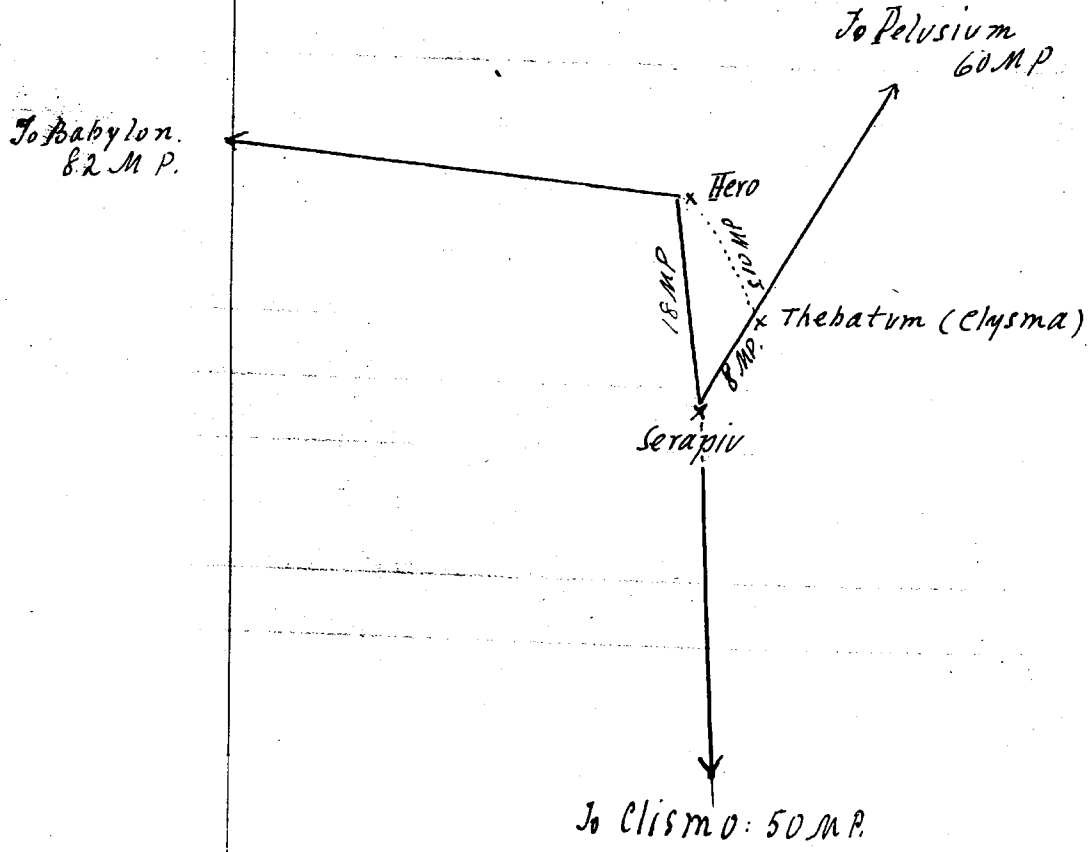
This agrees very well with the preceding. [c 130 A.D.?]

(3) This is the Clisma of the Pilgrimage of St Silvia. It is a fortified place - "castrum". It is "four desert stations" or five days' journey from "the city of Arabia", in the "Land of Gosen" (the wadi Tumilat): thus compatible with (1) and (2). cf Bernard pp 19-20 [38]. [379-388 AD].

(4) It is the κλυσμα καστρον of [illegible] of Heweles; being put by him in the second Επαρχια Αιγυπτια ὑπο τη Γεμμυκα: this Επαρχια being the southern division of the earlier undivided Επαρχια Αιγυπτος of Συνεκδημος: Wesseling p 728 [Hierocles Platonist of Justinian's day] [c 450 AD]

cf p 72

Heweles


To Pelusium
60 M P
To Babylon.
82 M P.
Hero
18 M P
12 M P
Thebatum (Elysma)
8 M P.
Serapiv
To Clismo: 50 M P.

The Northern Clysma - near Heroopolis

(1) This is the Clysma of the Peutinger Map. Its site is at the head of the Sinus Arabicus or Red Sea. It is opposite Arsinoe: it being on the eastern side of the Gulf, whilst Arsinoe is on the western. [c 200 A.D.]

(2) This is the Clusma of Navelle:- "At Ero is Clusma, M. VIIII = D" from Heroopolis to Clysma - nine M.P. cf Plinm: 3" edit: p 21. [c 306-307 A.D.]

(3) This is the Clysma of the Notitia Dignitatum Imperii. It is near Thebatum, which is the Thaubasio of the Antonine Itinerary, eight M.P. from Serapiu. This Serapiu is the starting point of two routes: (a) one to Pelusium on the Mediterranean: (b) the other to Babylon on the Nile via Hero (Heroopolis) The interval between Serapiu & Thebatum (Thaubasio) is 8 M.P: that between Serapiu & Hero (Ero, Heroopolis) is 18 M.P. The interval between Thaubasium, & Hero is thus about (18 - 8 = 10) M.P. But the Clysma of the Notitia is near Thebatum; therefore about 10 M.P. from Hero. Thus the Clysma of the Notitia is evidently the Clysma of both (1) and (2). cf Seeck: Not. Dignit. Or 28 l. 39: p 60. [c 350 A.D.]

(4) This is the Κόλπος of Philostorgius. He points out that the Red Sea ends in two distinct gulfs - (a) one running in the direction of Egypt & called the Gulf of Elysma: (b) another in the direction of Palestine, having the town of Aela at its head. This (b) is clearly the Aelanitic Gulf (Gulf of Akaba), showing that the other must be the Heroopolite Gulf (Gulf of Suez), with Elysma at its head. This is the first time that the Heroopolite Gulf is called the Gulf of Elysma. The latter name still clings to it in the Arabic form - Bahr Qulzum. The phrase describing Elysma, as at the head of the Gulf of Elysma, is a forceful one - κατὰ τὸ τέλος - i.e. where the Gulf dies away & terminates. This Elysma is evidently one with (1) (2) (3) - in the region of Heroopolis (Church History: III ch 6 & (p 618)) of Philostorgius: [c 374 A.D.]

(5) This is the Kolzum of Masudi (c 890-957 A.D.). It site is at a place called the Tail of the Crocodile - la queue du crocodile. Quatremère i p 174. The Crocodile is Lake Timsah & the Tail is its prolongation up the Wadi Tumilat. [c. 950 A.D.]

(6) This is the Kolzum of Makrizi (c 1358 - 1435 A.D.). It is also called Al-Kolzum & is distant from Farma a journey of a day & a night. Quatremère i. p 182.

This Fuma a the modern Ferama, near the ruins of Pelusium, on the Mediterranean. A camel-journey of a day & a night is some 50 miles, which brings one to the region of Ismailia. This Kolzim is therefore adjacent to Heroopolis [c 1400 A.D.]

In the light of these clear locations, we can now understand three additional references to what is evidently Northern Clysma:-

(1) Lucian, the Greek satirist, who was in later years a Roman official in Egypt, c 200, tells of a young Paphlagonian, studying at Alexandria - παιδευομενος ἐν Ἀθηναις: who having sailed up to Clysma - ἀναπλευσας ... ἀχρι του κολπου - takes shipping for India. Cf Diodorus: Alexander xxxii. 44 ... Lucian's statement indicates that there is a clear water way between Alexandria & Clysma. Ptolemy, a little before this, identifies the Trajan's Canal as a "going (618) ocean" (c 160). By sailing up the Nile to the head of the Delta, at a about the time of the inundation, it was easy for the young man to reach Clysma in the neighbourhood of Heroopolis & thus get off to India at the best season of the year for such a voyage.

(2) Epiphanius mentions κολπος καστρον as one of the three harbours of Egypt - the others being Aela & Berenice. Cf Πανάριον or Heresies: Bk ii Ch iii (p 618). (c 375 A.D.). This Clysma is almost certainly the same as the following one:-

cf p 68

† There is but one Ἀνυπόστατα in the Notitia Dignitatum: two occur after the time of Theodosius ii

(5) Hierocles mentions Κάστρον Κάστρον as one of the cities of the Second Province of Augusta, the inland division of what had once been the undivided Province of Augusta = Ἐπαρχία Αὐγούστα. He enumerates the towns from west & east - Leuka, Athribis, Heliou Babylon, Pharzithus, Arabia, & Κάστρον Κάστρον (3-6). As Arabia is here the "Civitas Arabia" of St. Silvia in the Wadi Sumilat, we may safely place Κάστρον Κάστρον in the region of Heroopolis. Cf Wesseling: "Συνεκδημος: p 728. [c 450 A.D.]

The Ethiopian of Eusebius, Athanasius, & Cosmas Indico-pleustes evidently belong here, but require discussion, leading too far from our present purpose

Conclusion: - It is now certain that there were two Ethiopian - both frontier towns & both fortified - Κάστρον Φουρίον in the south & Κάστρον Κάστρον in the north. Queen Mavia seems to have passed by the former in her invasion of Egypt with her Saracens in 377 A.D.; but that war ended in the simplest diplomatic settlement - a Roman general for the Queen's daughter & a bishop for her picturesque retainers. The Southern Ethiopia has no further interest for our research. But the Northern Ethiopia is highly important. It was a post for India in Lucian's time. It apparently continues to be such in the times of Epiphanius & Hierocles. i.e. well into the fourth century of our era

If in Herodotus a valuable witness to the extension of the Red Sea northwards, beyond Suez, up to the neighbourhood of Heroopolis and thus discredits some venerated views.

V. { The Bitter Lakes of Strabo - αἱ πικραὶ λίμναι: cf p 14.
{ The Bitter Fountains of Pliny - Fontes amari: cf p 17.

Their exact situation is of the utmost importance to our enquiry, specially as bearing upon the extension of the Red Sea northwards, beyond Suez, in ancient times. The Bitter Lakes of Strabo & the Bitter Fountains of Pliny are, without known exception, assumed to be identical by historians & geographers. So much is this the case that Pliny's Fontes Amari are nearly always cited as Lacus Amari; tho' there is no doubt about the correctness of the former reading. Further, almost all writers assume that the πικραὶ λίμναι of Strabo & the Fontes Amari of Pliny are represented by the modern Bitter Lakes so-called on the southern section of the Suez Canal. Linant Bey & Prof Saville are practically alone in dissenting from this view. yet again, the term λίμνη is usually taken to denote a very considerable body of water; but the term alone gives no clue to dimension; for it sometimes denotes an artificial pool; more often, it denotes a marsh, resulting from the overflow of a river or a sea, such as λίμνη Μοίρις of the Fayoum or λίμνη Σεφβουνίς of Lower Egypt.

* Herodotus also dug his Heliopolis Canal as joining the older Canal from Phacusa. Cf pp 19-20

* Smart Bay, as a first-rate engineer, held that the Bitter Lakes of the Suez Canal, of which as the Nipvai Πίκραι of Strabo could not have been thus conceived of the Nile. This is now easily demonstrable:- (1) Area of these Bitter Lakes = 436×10^6 sq. metres. (2) Let 6 m.m. represent daily evaporation (Cf Lyons: Nile p250). Then (3) annual evaporation is c 920×10^6 cb. metres; whilst (4) effluent annual of the fresh-water Canal = effluent of old Wadi Tumilat Canal c 940×10^6. Thus in the end influx of fresh-water = evaporation ∴ salinity remains unchanged. Q. E. D.

It can be shown beyond doubt that the Bitter Lakes of Strabo & the Bitter Fountains of Pliny have nothing whatever to do with the Bitter Lakes of the Suez Canal; tho' D'Anville, Lepère, Rozière, Quatremère, Lepsius, Kiepert, Wm Max Müller, & a host of other authorities assent to Sprecht view; for, on the clear showing of Diodorus, Strabo, & Pliny, as well as on the unimpeachable evidence of the Pithom stele, the Canal of Ptolemy ii, which ran thro the Wadi Tumilat, ended at Heroopolis*. It lay therefore entirely within this valley. But the Canal passed thro' the so-called πικραι λιμναι on its way to Heroopolis. They are entirely within the Wadi Tumilat. They have nothing whatever to do with lakes on the eastern frontier of Egypt. [They are [not even salt];] They are mere four marshes lying near the eastern outlet of the Wadi Tumilat Canal, which were cut through in the construction of this Canal, losing their sources, perhaps their saloniss, & the influx of the fresh water of the Nile*. These πικραι λιμναι are evidently none other than "the pools of Pithom", mentioned in the inscription of the eighth year of Merenptah, son of Ramses ii, of the XIXth dynasty, relating how the 'Shasu of Atuma (Edomite Bedouin) have been allowed to obtain a living for themselves & their cattle in the great estate of Pharaoh'. Cf Breasted: Anc Records of Eg: III §638

* Cf. Encyclopaedia Biblica: "Exodus" § 45: fn

Hen, as D Pliny's Fontes Amari, so frequently called Lacus Amari, the case is equally against the prevalent view of Egyptologists. Fontes & Aquae ~~should not~~ are should not be confounded. The former are live things, the latter are stagnant. Wm Max Müller (sic) charges Pliny with making the "amaros fontes" — navigable! Pliny's mind was not very critical; yet he remains one of Rome's greatest scholars. He does say stupid things at times, as when he ascribes a sense of justice & religion to elephants. But he was never stupid enough to call the Fontes Amari navigable. He speaks with scientific precision, when he says that the canal of Ptolemy extended up to or as far as the Bitter Fountains — usque ad Fontes Amaros. And there are the brine springs of Diodorus, attested by C. Sicard S. J., before the construction of the Suez Canal, (Cf pp. 64. 65): attested also by the French Engineers in 1799 as at 4,040 metres E. east of Nagfar. Cf Description: Etat Mod i. 166. These seem to have given to this eastern part of the wadi Tumilat the name of Saba Biar (Seven Wells). Yet the Fontes Amari have long ago vanished, we shall find the corresponding phenomenon before the digging of the Suez Canal, noted by Suess, viz, the rising & sinking of the wells of the Isthmus with the waxing & the waning of the tides, proving the existence of a common subterranean sheet of brackish water between the two seas, - a phenomenon still observable in the region between the Rhine & the Danube, proving the existence of a common underground sheet of fresh water

† Cf. Wm Marc Müller: Europa und Asien: pp. 39-45
Its identification of Km-ur with the Mediterranean Sea
& its derivation of the name Suph from a tissue
of speculations is the ne plus ultra of Egyptology.
His scholarship otherwise is not here in question.

between the two rivers. Cf Suez. i. 377

Conclusion. The position of the Πικραι λιμναι & the Fontes Amari are now firmly fixed; thus removing a mass of error & leading to clear views about the extension of the Red Sea northwards. Space does not allow us to deal with the Km-nr or Great Black (Water)* of the ancient Egyptian inscriptions & its supposed relation to the Bitter Lakes of the Suez Canal, the Πικραι λιμναι & the Fontes Amari, beyond saying that these supposed relations are demonstrably false, in the light of the foregoing classical data.

VI Extension of the Red Sea northwards beyond Suez.

This is the most disputed & most difficult, also the most perverted item in the whole of our research. We use for heading the current conventional phrase in this regard. And at the outset of our investigation here, we must carefully note the marked differences between the old & the new nomenclature:-

Geographically speaking the Red Sea of to-day is that arm of the Indian Ocean which extends from the Straits of Babel Mandeb northwards to the southern extremity of the Peninsula of Sinai where it divides into the Gulfs of

Cf Strabo: XVI. ii. 30

of Suez & of Akaba. These are the two ιιι ν ΧΥΙ of Strabo's Arabian Gulf, which is the Red Sea of the present day.[x] The oldest Egyptian designation for the Red Sea is the same as that for the Mediterranean, viz Uaz-vr i.e. the Great Green (Water); whilst the oldest Hebrew name for it is (in general) - Yam Suph or Sea of Weeds (Reeds); but neither the Egyptian nor the Hebrew name is of any consequence to us at present. The classical nomenclature is that which lies at the root of the problem on hand:-

(1) The Red Sea of the classical geographers - Ἡ Ἐρυθρὰ Θαλάσσα or Mare Rubrum is the Indian Ocean.

(2) Their Arabian Gulf - Ὁ Ἀραβίος κόλπος or Sinus Arabicus is our Red Sea.

(3) Their Heroopolite Gulf - ὁ Ἡρωοπολίτης κόλπος or Sinus Heroopolitanus is practically our modern Gulf of Suez. It is really to the Gulf of Suez that the phrase - "extension of the Red Sea northwards" strictly applies in the sequel:-

The alleged "extension of the Red Sea northwards" must not at all be confounded with the confluence of the Mediterranean & the Red Sea in the Bay of Lower Egypt, already described (pp 43-45). W Max Muller seems to fall

† Cf. Suess, [following Laurent] slightly differs from this view, which is founded on the later observations of Sir J. W. Dawson. Cf Science p 280 Cf also Suess I p 377

× Cf "Mémoire sur les limites de la Mer Rouge" in the Description: Et. Nov. Partie I

⊙ Cf Recueil des Travaux p 127

into the mistake of Encyclop. Bibl. : Exodus § 15. That great Bay of Lower Egypt was filled up in prehistoric times; & for the final completion, the Mediterranean, the Nile, & the Red Sea, took part, as shown § existing surface deposits. The agency of the Nile has been already dealt with here (pp 46. 47). Three zones are well marked in the Isthmus along the line of the Suez Canal. (1) the Mediterranean zone from the Mediterranean to the southern end of Lake Balah: (2) the Nilotic zone, beginning at the latter spot & going to the northern extremity of the Bitter Lakes: (3) the Erythraean zone, extending from the latter spot to Suez.

The present Gulf of Suez ends at Suez; — in our conventional phrase, we should say the Red Sea extends up to Suez. Her inquiry is as to its extension at an early date up to the region of Ismailia or Serapeum: with many others, Schleiden would allow such extension for prehistoric, but not for historic, times of the Land-enge von Suez (1856). D'Anville believed in extension northwards up to the head of the Bitter Lakes for early history. So did Lepère, Rozière, Du Bois Aymé, Renaut, with others. Lepsius, on the other hand, held that such extension of the Red Sea northwards was clearly disproved § the traces of the Canal of Darius on the route marked § his stelae up to the neighbourhood

of Suez (cf pp 22. 23); since, according to this authority, no such canal could have been cut, had there been an open marine channel alongside of it. But this proves too much; for "by the same token" no fresh-water canal should have been dug alongside of the present Suez Canal from Ismailia to Suez. yet Sayce & others have given their adhesion to this theory of Lepsius. Linant Bey, on the other hand, goes too far in his assertion that, when he makes the Red Sea, in the 19th dynasty extend up to Lake Balah; for that lake is quite outside the Erythraean zone already mentioned (p 79). Sir J. W. Dawson, on geological evidence, believed in the extension of the Red Sea up to [the Bitter Lakes] at the time of the Exodus. Cf Science p. 276 Naville's view of the Exodus assumes such extension of the Red Sea for this period. Our thesis is that the Red Sea extended up to the region of Magfar at least, in the time of the 18th dynasty, & continued so to do until these happenings: —

(1) Its northern extension above Suez was cut off by the Coptic Christians of the Roman Empire, as a precaution against Arab invasion under at the rise of Islamism.

(2) The channel was cleared out again by Amru, under Omar - "Prince of the Faithful" - about the

Al-Mansur: 754-775: founder of Bagdad.

year 642 A.D., & permit the conveyance of supplies from Egypt to Mecca & Medina, then desolated by famine. The channel was closed again by Al-Mansur in 767 A.D. Cf p 91

(3) The channel was re-opened by Al-Mansur's son about 775 A.D., and remained open for some 200 years. Cf. p 91.

(4) The channel was probably re-opened by Hakim, "the mad Caliph" about 1000 A.D, but was silted up some 200 years later. Cf p.p 91-92

Proofs of the extension of the Red Sea northwards in earlier & later times may most conveniently start with Strabo's time, as a sure & convenient terminus a quo, proceeding backwards, & then downwards, as far as the evidence will carry us. Our inquiry, therefore, divides itself into two parts: (1) relating to the remote past: (2) relating to the nearer parts of more modern times.

i Extension of the Red Sea & the Wadi Tumilat from the time of Strabo backwards to the time of the 18th Dynasty

Heroopolis - Pithom is a fixed & well-known point, since the excavation of the site by Prof. Naville, & it furnishes now the first for our research: —

I The evidence of Strabo: c 24 BC: —

(1) Heroopolis is situated in the recess of the Arabian Gulf — ἐν τῷ μυχῷ τοῦ Ἀραβίου κόλπου. Strabo: Geography XVI. IV. 2: XVII. III. 20. This recess is also the Heroopolite Gulf, here seen to extend to the region of Heroopolis

(2) Heroopolis is itself a sea-port. Ships sail from it to the hunting grounds for elephants in the land of the Troglodytes. Op. cit: XVI. IV. 4.5. This again is proof that the Red Sea extends up to Heroopolis in the wadi Tumilat.

(3) Near Heroopolis are the towns of Arsinoe & Clesphatis Op. cit XVII. I. 26. Near Clesphatis is the exit of the "old canal" of the wadi Tumilat, where Aelius Gallus built 80 triremes & biremes & galleys for his expedition against South Arabia. These ships sail thence directly, without let or hindrance of canals, to Leuce Come in Arabia: XVI. IV. 23. Strabo knows of no Bitter Lakes on the site of the modern Bitter Lakes of the Suez Canal, strung together by canals. He knows of no canals in this region, except the wadi Tumilat Canal. This is clear proof that the Red Sea now extends right up to the region of Heroopolis in the wadi Tumilat.

cf p73

(4) The "old canal," ut supra, near Clesphatis, was clearly in working order in Strabo's time. It is so close to Arsinoe that it sometimes bears that name (p44). It is near Arsinoe that the wadi Tumilat Canal "empties itself into the Red Sea or Arabian Gulf": Op. cit. XVII. I. 25.

Here the Canal is filled up with a lock or sluice, "thro' which ships ~~pass~~ sailed into the outer sea"; XVII. i. 25. The canal is, therefore, on the inner or western side of the lock or sluice; whilst "the Red Sea or Arabian Gulf" is on its outer or eastern side. Nothing could more conclusively show that the Red Sea extended up to the region of the Wadi Tumilat.

II The evidence of Diodorus: c 60 BC:- He notes the completion of the Canal of Ptolemy ii, with its ingenious lock at its distal extremity near Arsinoe on the Red Sea. He evidently regards it as a sea-port: (I 64). Like Strabo, he knows of no canals or Bitter Lakes preventing absolutely free navigation from Arsinoe southwards to the land of the Troglodytes (in Upper Egypt). He knows of and describes the deep-keeled (βαθυπλοοι) elephant-transports which use the waterway. (Bk iii c 8 3). There being no transhipment of their cargoes of elephants possible, these elephant-transports go from the hunting grounds right up to Arsinoe at the head of the Heroopolite Gulf: thus proving the extension to the Wadi Tumilat.

III Evidence of Artemidorus: c 100 BC:- He makes Heroopolis a sea-port for those engaged in the hunting of elephants on Troglodytica. Cf Strabo: XVI. IV. 5. Again, no indication of any canals or Bitter Lakes,

such as the vast majority of modern authorities postulate. The Red Sea ends at Heroopolis

IV Evidence of Agatharchides: c 113 BC. He, in all respects, is an authority of the highest value. His treatise in five books, on the Erythraean Sea, has been preserved in part by Photius & Diodore. It has much to say about elephant hunting. It describes the elephant-transports - ἐλεφαντηγοί - & the perils they ran. Cf Photius ch. 83 in Müller: Gr. Hist. Gr. i. 171-3. He is the prime authority for Diodore, Artemidorus, & Strabo, in the matters on land.

V Evidence of the Pithom-Stele of Ptolemy ii: 269 B.C.:- This tells, inter alia, of the dispatch by Ptolemy ii of an expedition in this year, for securing elephants for war purposes. It sails from Hesmot & Negro-land & returns to the port from which it departed, with great store of elephants. There is no transhipment, as von Marc Müller suggests: no such thing is possible. Cf Arsen u. Eur. p 42. No: "the Ptolemies never helped nature in the south", & any canal there. Cf. ante p 43.

VI Evidence of Theophrastus: c 330 B.C.:- He was Aristotle's successor as head of the Peripatetic School; best known as a botanist, but almost as great as his master in science &

* Herodotus: - Ἐφ ὃν καταβαίνουσιν οἱ ἐξ Αἰγύπτου ...
IV. 7. 2: - κατὰ τὸν παραπλοῦν ὃν ἐξ Ἄρωνν
ἐπιοῦντο κόλπου ... IX. 4. 4: - παρὰ τῶν
ἀναπλεόντων ἐξ Ἄρωνν πόλεως ...
IX. 4. 9.

* Sanscrit: Easyapa-pur: believed to be Cashmir

Cf Dr. Stein's Notes on Rājat. and sea. Cf p. 126

phil. zation. In his Historia Plantarum, he Theophr. mentions Heroopolis as a sea-port. Cf IV. 7. 2: IX. 4. 4: IX. 4. 9: showing that it was in his time a busy place in this respect: proving extension of the Red Sea up to the wadi Tumilat

vii. Evidence of Arrian. He belongs indeed to the times of Hadrian & Marcus Aurelius, but he makes use of original sources for his Anabasis of Alexander - viz Ptolemy i & . He twice mentions Heroopolis in this work: but the important reference in this connection is to appointment by Alexander of one - Cleon - to circumnavigate, in a triaconter, the peninsula of Arabia right up to the Arabian Gulf of Egypt (πρὸς Αἰγυπτίους) - up to Heroopolis Cf Anabasis VII. 20. 8. The Red Sea therefore reaches Heroopolis still. Again there are no Bitter Lakes: no canals to negotiate before reaching the port of Heroopolis. c. 323 BC.

viii. Evidence of Darius: - He sends out his exploring expedition under Scylax from Caspatyrus, down the Indus & the Indian Ocean. The fleet arrives in the 30th month at the place whence Necho had despatched his expedition to circumnavigate Africa. Cf Herodt. IV. 44. The port of arrival is not named, but it could hardly be other than Heroopolis - Pithom. Duncker adopts this view. After this exploring of the Indian seas, Darius "subdued the Indians & began to frequent this sea" Op cit. IV. 44 The date is c 512 BC. It is only at a later date

He visited Memphis in his 5th year: 517 BC

that Darius made use of the Red Sea & the Nile, via the Wadi Hammamat, where his inscriptions occur for the 26th, 27th, 28th, 30th & 36th years of his reign. This late use of these ports agrees well with an earlier use of the port of Heroopolis. Ptolemy ii, for his general sea-borne traffic, had to change from Heroopolis & the ports of the Red Sea in Upper Egypt, as more convenient for him cf Strabo: XVII. i. 45. The extension of the Red Sea northwards to Pithom (cont. this date)

IX Evidence of Neco:- The port from which he dispatched his expedition to circumnavigate Africa is taken from Herodotus as already known. It could hardly be other than Pithom, — the terminus of the Wadi Tumilat Canal, & probably one of the places of building of his fleet. cf Herodot. IV. 41: ii, 159 His object in circumnavigating Africa was probably commercial aggrandisement in compensation for his defeat of Nebuchadnezzar at c 605 BC. The success of the circumnavigation has been proved by Bourriant's scarabs. His use of the Wadi Hammamat route, ut supra, is attested only for his 8 "year"; & the same inference may be drawn as in the cases of Darius & Ptolemy ii. The extension of the Red Sea northwards to Pithom (Heroopolis) may also be fairly assumed for this date. (c 605 BC

XII Evidence of Ramses ii. The extension of the Red Sea up to the region of Pithom or even beyond is assuredly proved by the existence of Raamses as a sea-port for

* Mem. Not. published 77 AD

this period - 1292 - 1225 BC (1292-1225). Voyages to the Holy Land of Punt were now common. Cf Maspero: Struggle p 408.

IX Evidence of Queen Hatshepsut: c 1501-1447 BC. The extension of the Red Sea up to the Wadi Tumilat is furnished by this queen's expedition to the Holy Land of Punt - "the Terraces of Incense". Cf p 51. Tothmes iii continued these expeditions, evidently also by the Wadi Tumilat route.

Conclusion:- So far the case has been made good for the extension of the Red Sea northwards, beyond Suez, up to the Wadi Tumilat from the time of Strabo up to the 18th dynasty. Students of Geology will have no difficulty in tracing that extension back-wards in time to the Post Pleistocene period. pp 53-54

Cf p 81

ii Extension of the Red Sea to the Wadi Tumilat from the time of Strabo downwards to its cessation about the 12th Century

I Evidence of Pliny, the Elder: c 75 AD. His statement is indeed confused, but his picture of Arsinoe on the Gulf of Heroandra (pp 18. 64.) makes sufficiently clear the extension of the Red Sea in his time to the region of Heroopolis. His Heroandra seems homophonous with the Kenneruna

* Suez Canal: Cf Wilberg: pp 278. 286

* IVa. Evidence of Agathemerus. His date is uncertain but he suffers an injustice in being placed in point of time close to the final redaction of the Peutinger Map. His outline (ὑποτύπωσις) of geography is somewhat slender; but at this point it gives back upon Eratosthenes & gives quite unequivocal proof of the extension of the Red Sea up to Heroopolis – ὁ δὲ Ἀράβιος κόλπος ἄρχεται ἀπὸ Ἡρώων πόλεως. Another reading for πόλεως is ποταμοῦ – (BCDEH), which would indicate that the Wadi Tumilat Canal was now called the Heroopolite Canal Cf Müller: Geogr. Gr. Min. ii p 475

of the Pithom-Stele cf p. 129

ii Evidence of Plutarch: c 100 A.D. His account of Queen Cleopatra dragging her ships across the Isthmus to escape from Augustus is mistaken in part (p): but his estimate of the Isthmus as very narrow (300 stades!) shows his knowledge of the extension of the Red Sea up to the region of the Wadi Tumilat at this date. cf pp. 15:16

iii Evidence of Ptolemy: c 150 A.D. He gives three positions:-
"Head of the Heroopolite Gulf long 63° 30' lat 29° 5'
Heroopolis long 63° 10' lat 30° 0
(cf. Bk IV. cp V). This places the Red Sea, as the Heroopolite Gulf, adjacent to Heroopolis in the Wadi Tumilat.

iv Evidence of the Peutinger Map. This is visual testimony furnished by a Roman military map, known therefore as remarkably accurate. It makes the Sinus Arabicus - or Red Sea - proceed without the slightest obstruction, natural or artificial, to the neighbourhood of Arsinoe to the Bitter Lakes. cf p 65. It is an independent witness to the existence of the Red Sea, ut supra, at the interval between c 150-250 A.D.

v Evidence of Ptolemy. He holds that Trajan's Canal was

* Cf Recueil : p 197

used for the transport of porphyry & granite from the quarries of Gebel Dokkan & Gebel Fatireh in the Thebaid (p) until about the years 205 - 209 A.D., when new granite quarries were opened at Syene. The inference is that the Canal of Trajan had by this time become silted & thus new quarries had to be opened on the Nile. This view is a precarious one; for many other reasons might operate for the closing of the old granite quarries at Gebel Fatireh. The argument indeed proves too much; for if the export of granite ceased as above, then the export of porphyry should also have ceased. Schonne, indeed, has no answer to this, but a very insufficient answer (p x). Lepsius quotes Langlès' Rec., who shows from Makrizi that, until the rise of Islamism, vessels brought to Arabia the wares of Egypt, but since the conquest of Egypt, the communication was interrupted, the canal (of Trajan) being obstructed & the navigation having been abandoned. Cf Langlès: Notices et Extraits, Tom VI pp 337. 340. 366. From this, the statement of Amru, governor of Egypt under the Caliph Omar, Lepsius draws the inference that the Canal (of Trajan) had been designedly filled up by the Egyptians before the conquest of Egypt, as an inimical & prudential measure, similar to that taken by the Caliph Mansur at a later date. Cf Lepsius: Egypt, Ethiopia, & Syria: p 445. This inference seems well founded & fits into what has often been spoken of with extreme surprise, viz.

* This is opposed to the view of Lepsius himself. Cf p.

* attested by Al-Kindi, El-Beldery, Makrizi, Sefems-Eddin

* The name of the rebel is Mohammed-ben-Abdallah-ben El-Hossein-ben-Ali-ben-Abu Talib.

* He also built the El-Hakim mosque in Cairo

the completion of the Canal of Omar in six months: & we may still suppose, then, that the Red Sea extended still, as before, up to the region of the Wadi Tumilat".

VII. Evidence of Arabic historians. This may be here summarised & concluded:- (1) It is a well attested fact that the Caliph Al-Mansur, founder of Bagdad, ordered the filling up of Omar's Canal, so as to stop supplies from Egypt to Arabia, on account of the rebellion against his authority in the city of Medina. The canal was closed. The channel was obstructed in 767 A.D. & remained so for some eight years, when it was reopened by Al-Mansur's son & successor. (2) Al-Kindi expressly says that the Canal of Omar remained navigable until the time of the Caliph Abdul-Aziz (975-996 A.D.), when it fell to ruin through neglect. (3) Hakim, son of the preceding, "the mad Caliph", is sometimes recorded to have re-opened the old Canal of Omar. Makrizi states that in his time, the canal bore the name of Hakim. So also does Shems Eddin, who wrote a complete history of Egypt (c. 1650). The association of Hakim's name, with the old canal, could scarcely have come about without some such reopening of the canal by him. He had, doubtless, an abundant supply of labour for such a purpose, as he was a severe persecutor of the Christians. The date of such re-opening is about 1000 A.D. (4) Abu Salih, writing in the

* Prof. Hull says 7 ft.; no doubt correctly for the part reviewed, as the salt cake was not of uniform thickness. Cf Survey of Western Palestine: Gorlov: p 72

the twelfth century, makes it clear by that time, if not earlier, the channel & the sea was closed; for wheat, now brought by Nile boats & the eastern extremity of the wadi Tumilat, at the place called As-Sadr, is transferred from the bank & dealers, who travel with it & Mecca & Medina. Cf. Evetts (& Butler) in Anecdota Oxoniensia (1895): p 173.

Conclusion:- Taking a conjunct view of the foregoing evidence, it becomes manifest that, contrary & all received opinion, the Red Sea has extended up & the region of the wadi Tumilat from the XVIII th dynasty - 1500 B.C. & somewhere near the time of the Caliph Hakim - c1000 A.D. From that date or thereby, our problem as & the extension of the Red Sea northwards, is handed back by History & Geology. It is possible that some connection with the wadi Tumilat may have remained till later times, but, if such were the case, navigation had ceased beyond Suez. In the bottom of the Bitter Lakes, before the construction of the Suez Canal, was found at one part a huge cake of salt - some seven metres in thickness of Suez i.382. cf Hull also. (7.5)
It can be shown that for such a thickness of salt, there must have been evaporation of a column of Red Sea water, more than 1800 ft. high; & the evaporation of such a column, at the rate of 6 mm per day, (p 75a)
(75a

* Despite his high doctrine of "strand lines", he here, as occasionally elsewhere, lapses into the phraseology of Lyell. Cf p 378 "coast-line sinking"

would require some 250 years. If, therefore, on the testimony of Abu-Salih (p 91) we suppose the Nile waters to have been practically cut off from the former basin of the Red Sea in the region of the Wadi Tumilat & the retreat of Red Sea & the head of what are now the Bitter Lakes in the Suez Canal, we may suppose a continuation of the connection of the Red Sea with the basins of these Lakes, for some 250 years after the cessation of the restored Canal of Hakim. These basins of the Bitter Lakes were cut off from the Red Sea by the elevation of the land in the region of Suez; & that elevation was some 10 ft in extent, judged by the remains of the old canal in this region. Suess judges the movements of elevation in the Isthmus to have been rhythmical (i. 378) If so, we might suppose the last step in this elevation of the land near Suez (Chalouf) to have occurred about (1100 + 250 = 1350) years A.D: i.e. in the middle of the fourteenth century or thereby. There is no concrete history, either for or against this view, & nothing in the sequel is made to depend upon it.

The Engineering Problem

This is essentially the problem of canalising a

* This applies to all the old Canals under considera-
tion, save that which, for convenience, we have
already called the Northern Canal. cf. p 36

* cf Homer: Διίπετης ποταμός: Od. IV. 477

* A great puzzle to Dr Livingstone

* Aristotle gives the correct explanation in his Meteora: i. 12. 19.
It was well known even before Strabo's time: xvii. i. 5

river, subject to a periodic inundation of great magnitude, but of the utmost regularity. The problem here is as complex as the Nile itself, but the pure technicalities are of the simplest sort. We have to note, on the threshold here that there is no problem of excavating a canal purely de novo. The excavations are all repairs or slight modifications of a Natural Channel - excavated & kept open from Post-pleistocene times onward until now, an arm of the Nile flowing down the Wadi Tumilat. cf pp 46-54 The case requires us rather to realize the ancient conditions of the Canalization, as no abstruse problems are otherwise to hand. Yet the problem, reduced thus to a minimum, remains a formidable one & requires a very extensive research.

1) The general conditions of the problem.

The sources of the Nile did not awaken much curiosity among the ancient Egyptians their Hapi - or Hidden One - was associated with Qerti or Qoriti - "the two holes" whence emerged the Nile-god at the period of the inundation. The Kenophi & Mophi of Herodotus (ii. 28) are respectively "the hollow" & "the waters" - of the Nile. Herodotus quotes the views of Thales, Hecataeus, & Anaxagoras regarding the rise of the Nile, then gives his own (ii. 19. 27). Nero had curiosity enough, to send out a party to explore (the)

* Herodotus Loeb Class only: ii. 17

Use carefully!

the upper Nile and their report would show that they reached the marshes of the White Nile. Cf Pliny: N. H. VI. 29 §§ 184-186: Seneca: Nat. Quaest. VI. 8. But to follow such points is irrelevant to our research at this moment. Rather, must we note that, according to Captain Lyons, the length of the Nile from the Ripon Falls to the Rosetta mouth of the River is 5,589 kilometres or 3437 miles: the catchment area — 2,867,600 sq. kms. or 1,107,227 sq. miles of Nile 5-7. The mouths in classical times were seven — (1) Pelusiac: (2) Tanitic: (3) Mendesian: (4) Phatnitic: (5) Sebennytic: (6) Bolbitic: (7) Canopic. Now there are but two — those of Damietta & Rosetta

Mean Discharge of the Nile to-day:-

Sir Wm Willcocks gives these in his Egyptian Irrigation: cf pp 48-52:-

(1) Rainfall of the Nile basin = 2,282,000,000,000 cb. metres per annum

(2) Mean discharge at Aswan = 94,292,640,000 cb. metres per annum

(3) Mean discharge at Cairo = 82,308,960,000 cb. metres per annum

(4) Mean discharge into the sea = 64,964,160,000 cb. metres per annum

+ (a) $64,964 \times 10^6 / 2,282,000 \times 10^6$

+ (b) $(82,309 - 64,964) \times 10^6 / 82,309 \times 10^6$

× Thro': 1st April & end of July.
Summer: 1st Aug. & end of Nov.
Winter: 1st Dec & end of March.

$946 \times 10^6 / 82,309 \times 10^6$

Cf Girard's Memoire on the Elephantine nilometer &c:
Description: Antiquités: vol i pp 1-47

(5) Hence follow two things:- (a) The water which reaches the sea is about 1/35 of the rainfall*: (b) the water absorbed by the canals of the Delta is about 1/5 of the supply at Cairo**.

(6) For the Ismailia Canal, which is virtually the old Heliopolite Canal (p. 19.) as far as Ismailia, the discharge figures are for 6 the flood*, 11 cb. metres per sec: (2) summer*, 29 cb. metres per sec: (3) winter* 50 cb. metres per sec. cf Willcocks: Irrig. 183 The average discharge thus becomes 30 cb. metres per second, & the annual discharge thus becomes = 946×10^6 cb. metres. The average discharge of the Ismailia Canal is therefore about 1/90 of the whole discharge of the Nile at Cairo*. This may be taken as approximately representing the discharge of the old Wadi Tumilat Canals.

The Regimen of the Nile

The Nilometers of Ay-day are graduated wells with fixed scales to determine the rise & fall of the Nile. The earliest of all Nilometers is that cut by the officials of Amenemhat III of the 12th dynasty (1849-1801 BC) on the rocks of the River at Semna near the second cataract. The records are marks on the rocks, entering those years of the reign of

Amenemhat III – 3", 5", 7", 9", 14", 15", 22", 23, 24", 30", 32", 37", 40", 41" & 43" years. Lepsius held that these marks on the rocks denoted that the inundations of the Nile were some 25–30 ft. higher than those of the present day. Hall has contested his views; & the apparent lowerings of the inundations in later times are now best explained by the attrition of the Nile bed, which works out at the very modest figure of one inch per century. Captain Lyons has given a list of ancient Nilometers from Semna downwards — (1) Semna: (2) Kubosh: (3) Jaifa: (4) Philae: (5) Elephantine: (6) Kom Ombo: (7) Silsila: (8) Edfu: (9) Esna: (10) Karnak: (11) Luxor: (12) Zehne: (13) Kom el Giza:

Nile p 316

The rise of the Nile is noticed at Khartoum about the beginning of May; at the first cataract, about the beginning of June; at Cairo, about mid-summer. The inundation, according to conventional ideas, lasts 100 days. Cf Herod ii. 19 & onwards. The old Egyptian New Year Day was 15th Sept., as marking the climax of the inundation. The function of the Nile, with reference to the landscape is described in poetic terms by Amru – "According to the changes of the seasons, the face of the country is adorned with a silver wave, a verdant emerald, & the deep yellow of a golden harvest."

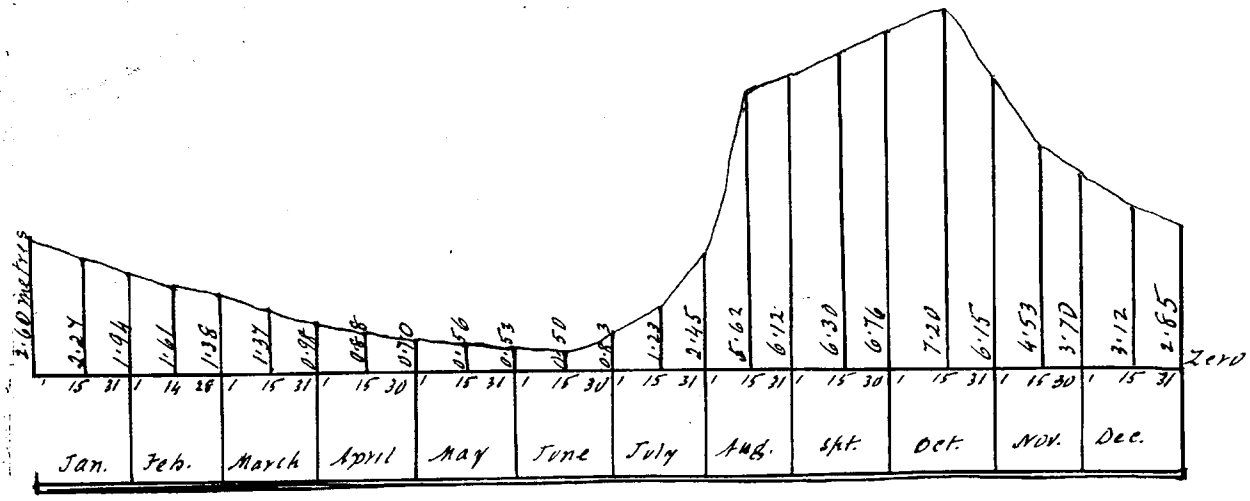
The Height of the Inundation

† Now in the Vatican.

Cf Isis & Osiris: 43
Cf also Strabo xvii. i. 3 Before the time of Petronius, governor of Egypt under Augustus, 14 cubits gave the greatest plenty: under him, (the canals were cleared out, and) 12 cubits of a rise (ἀναβάσις) gave a most abundant crop.

* Nilometers of Semna, Kom Ombo, Silsila, Karnak, & Dehme are not mentioned here

① Nilometer cubit = 0·525 m = 20·6 inches
Public & Ptolemaic cubit = 0·450 m = 17·7 inches



Curve of Nile surface 1846, taken at Kodak gauge by Mougel Bey, 1846: engineer at the Nile Barrage. This may be considered a typical curve, as the year 1846 presented no unusual features in the regimen of the river.

Minimum above theoretical zero in middle of June = 0·50 m = 1·64 ft

Maximum above theoretical zero in middle of Oct. = 7·20 m = 23·61 ft.

The Optimum has from early times been reckoned at 16 cubits
In the Temple of Peace, Vespasian dedicated, in "basanites"
stone, the group representing the Nile-god with his 16
children sporting around him. cf Pliny xxxvi. cp 11.
The height of the inundation varies, of course, with the site of
the observation, & the 16 cubits symbolised in the above group,
no doubt, refers to Memphis. Plutarch gives 14 cubits as
normal (δίκαι·); probably Lee copying Aristotle. But
the place of measurement is not given; & , even, if it had,
the 16 cubits, as above, are not to be set aside; for Captain
Lyons has shown that the Egyptian cubit was not an
invariable measure. Measurements made at the ancient nilo-
meters mentioned on page 97, reveal considerable divergences in
the value of the cubit. cf History of Surveying and Land Measurement
in Egypt: pp 14. 15*. He also gives as value of the Nilometric
& royal cubit = 0.525 metre; cloth-weavers' cubit, = 0.375 metre,
public & carpenters' cubit = 0.425 metre (+) cf Cadastral Survey
of Egypt pp 36. 37.

Regularity of the Regimen of the Nile

The cycle of nature here proceeds with amazing regularity, for
each season, as also for the ages. Captain Lyons here cites
the conclusions of Dr Borchardt in his paper on "Nilmesser
und Nilstandmarken" :- "The height above sea-level
of corresponding points of the ancient nilometers in Egypt +—

* Preserved in the Palermo Museum.

† Built Umitt Line of El-Walid c. 715: second of the brother of Walid c. 860: (Under Pasha 860 n 870: Willcocks: 861 BC.

Nubia have been determined with the aid of the bench-marks of the Irrigation Department; & the zero points of the nilometer scales were found to lie in a line inclined to the north. In Nubia, the line is possibly parallel to the water-slope, but north of Aswan it is considerably less inclined than the flood-slope; consequently a flood was indicated by a higher reading on the nilometer at Aswan than on that of Roda at Cairo. This explains the statement found in the Egyptian inscriptions & in the works of the Greek & Roman authors, that the Nile in very good years rose 28 cubits at Elephantine, 21 cubits at Copt, 14 at Roda (Memphis?), & 7 in the Delta. From the slope of the line determined by the zero points of the nilometers, the altitude of the ancient nilometer, at or near Roda, may be approximately obtained, & after calculating the secular rise of the bed, it can be deduced that the flood levels about 3000 B.C., which are recorded on the Palermo stone, & the data concerning Nile floods given by the Greek & Roman authors, agree well with those of to-day" Cf Lyons: The Nile: pp 316-317

The Rise at the Roda Nilometer.

This is - the Nilometer - of to-day, & which all other nilometers can be referred in the light of the preceding statement. It is on the island of Roda, opposite old Cairo, 27 kilo-

* The Barrage is 23 kms down-stream from Cairo

** Cf <u>The Nile</u> : pp 319-323

above
metres (from) the Barrage or present head of the Delta. Captain Lyon has very fully discussed the readings of the Roda nilometer for different periods. ++ It is enough, therefore to note two sets of readings on which there is little doubt: -

(1) In the years 1825-1872: Maximum = 7·17 metres, = 23·52 feet

(2) In the years 1737-1800 Maximum = 7·02 metres = 22·96 feet

The mean of these two maxima works out at 23·24 feet. We may, therefore, reckon it in a general way as equal to 23·50 feet, & on the strength of the statement of Burchardt, we may suppose this to lie the dominant maximum rise of the inundation up to & beyond historic times.

Economic Aspects of the Rise of the Nile.

These throw light, not only upon the condition of the Delta, but also upon that of the Wadi. Pliny mentions that 16 cubits is the most desirable height of the Nile. If less, it does not overflow the whole (cultivated) land; if more, cultivation is retarded & the time for sowing may be lost. When it rises only 12 cubits, famine ensues; at 13 hunger still results; 14 cubits is productive of gladness; 16 produces unbounded transports of joy. Bk V. ch 10. But the economic effects of the rise of the Nile have never been stated so well as by Talabot, one of the international engineers appointed to the survey for the Suez Canal

* Nuisible

Au-dessous de 5m 40	Famine
De 5m à 6m	Crue insuffisante, disette
De 6m à 7m	Récolte faible
De 7m à 7m 50	Récolte favorable, abondance
Au-dessus de 7m jusqu'à 8m	Crue forte, devenant de plus en plus nuisible
Au-dessus de 8m	Crue extrêmement nuisible, famine certain, danger de peste

Secular Rise of the Nile-bed:—

This must be distinguished carefully from the rise of the flood-plain. The cause is the same in each case, viz - the deposit of Nile mud or alluvium. This is almost entirely derived from the highlands of Abyssinia, thro' the Atbara or Black Nile:

Secular rise of the River-bed

This is the balance between the material eroded in the bottom of the stream during the inundation, & the silting of the bottom of the stream, with the slackening of the inundation. The French Engineers (1796-1801) made careful observations on the rise of the Nile-bed by measuring the accumulation of the alluvium in the riderneles for known periods. MM Girard & Rozière reckoned this rise of the river-bed at 12 centimetres per century, for the region of Cairo & Memphis. Since the foregoing date, other observations have been made & may be thus summarised:—

Cf Vonhe Pasha in Zeitschrift für Aeg. Sprache xxxiv. (1896) reckons the rise @ Karnak at 0.026 metres per century: cf pp 103. 101. The Egn figures would raise somewhat. cf Nile p 315

* But on Nile pp 313. 334 - 10 cms

(1) At Elephantine, dating from the year 100 A.D. until to-day, a rise of 3m 18 cm has been ascertained. Rise, therefore, = 16 cms per century. (Borchardt).

(2) At Elephantine again, dating from the middle of the reign of the Emperor Severus c 200 A.D. & 1800, the rise is 2m 11 cms in 16 centuries. Rise, therefore, = 13·2 cms per century. (Willcocks)

(3) At Karnak, dating from the reign of Osorkon ii, c 860 B.C. until to-day, rise is 2·68 metres in 27·5 centuries. Rise, therefore = 10·0 cms per century. (Legrain: corrected).

(4) [Ventre Pasha] At Roda nilometer, dating from 861 A.D. & the present time, the rise is 1·22 metres in 10·30 centuries. Rise, therefore, = 12 centimetres per century. (Willcocks)

It is thus apparent that the rise of the Nile-bed is not uniform, & such a thing is to be expected. All we are concerned with here is the rise of the Nile-bed in the region of Cairo; & all authorities are well agreed in fixing that somewhere about 12 centimetres per century. This is the figure given by Girard & Rozière; by Sir Wm Willcocks 12 & 13 cms per century are mentioned. Cf Eg. Irrig p 41 Captain Lyons gives it as 12 cm per century. (2) Cf Willcocks: Egyptian Irrigation. + Prof. Petrie gives 12 cms per century for the region of Naucratis. A general view

of these figures would suggest 4·5 inches per century as a good working hypothesis for the region of Cairo at large.

Secular Rise of the Flood-plain.

This is a matter of rather small importance for our research, as it is really a quantity which varies with locality. The largest deposit of alluvium occurs near the banks of the river, where the overflowing water is first checked. The deposit tapers away with the distance from the margin of the river. The elaborate measurements of Horner & the difficulties involved in these are too well known to require discussion. Two figures, viz 3·8 inches of rise per century for the flood-plain at Heliopolis, & 3·5 inches per century (of rise) for the flood-plain at Memphis are now regarded as too low. cf Philosophical Transactions, 1855: pp 105-138; 1858: pp 53-87 A few figures to hand may be of interest regarding the secular rise of the flood-plain:-

(1) Elephantine	6·3 inches per century (Wilkinson)
(2) Karnak	6·5 inches per century (Venture Pasha)
(3) Memphis	3·5 inches (Horner)
(4) Babylon	12·0 inches (Botta)
(5) Le Caire	4-5 inches (Girard)
(6) Roda gauge	5·5 inches (Venture Pasha)
(7) Heliopolis	4·0 inches (Wilkinson).
(8) Nineveh	5·3 inches (Botchardt)

* i.e. the "flood-plain"

** Cf Zeitschrift für Äg. Sprache Bd. XXXIV (1896) pp 95-107.

* He regards the evidence as insufficient to establish use of bread as faster than rise of sweet-bread

Does the Nile-bed rise faster than the flood-plain?

This is the question which arises out of the relation of the rise of the river-bed & the rise of the flood-plain. It has immediate relation & our research, as bearing upon the "off-take" of the wadi Tumilat canals. Ventre Pasha, from observations at Karnak, made the rise of the cultivated soil* = 0m 143; whilst the rise of the river-bed was found = 0m 096 - per century**. In the 28 centuries under review here, the rise of the soil exceeds the rise of the river-bed by 1m 32 or 4·33 ft. Such a gain of the flood-plain upon the river-bed would scarcely be appreciable in practice. For the Delta, the view of Girard & Rozière that both advance pari passu seems fairly well founded. Cf Description: also Jalabert: Revue p 486 Captain Sims, however, indicates a somewhat different view*. Cf Nile p 317

Shiftings of the Head of the Delta

This seems to throw a little light upon the foregoing problem. The slope of the Nile in the Delta is very slight & diversion of the stream is therefore easy; but it seems more reasonable to ascribe changes in the Head of the Delta & the flood-plain failing to

* Fork of the legs of Osiris

* In the time of Ptolemy ii, c 269 BC, head of the Delta is at Heliopolis: this the source of Ptolemy's second or Heliopolitic Canal. cf p 131

(6) and (7) are emphatic sentences of Sir Wm Willcocks

near Bari-passes with the river-bed. In any case, we find that the head of the Delta has varied very considerably in the course of the ages:-

(1) In the time of Herodotus: c 450 BC, it was at Kerkasoros, now Shubra, about 6 miles north of the Roda gauge. (ii. 15)

(2) In the time of Strabo: c 24 BC, it was near Heliopolis, about 11 miles north of the Roda nilometer. xvii. i. 30

(3) In the time of Pliny: c 75 AD, it was 15 M.P. below Memphis, or about 2·5 miles north of the Roda nilometer (H.N. V. 9.)

(4) In the time of Trajan, c 120 A.D. it was at Babylon, or a little north of the Roda nilometer. Cf Ptolemy. p 18

(5) In the time of Omar, c 640 A.D. it was at the same place (Fostat).

(6) 'From the seventh to the twelfth century, it has apparently been approaching Cairo.'

(7) 'From the twelfth century, it has been receding from Cairo.'

(8) To-day it is at the Barrage or about 15·5 miles north of (below) Roda

We now note that the Canals of Ptolemy ii (second canal), of Trajan, & of Omar were drawn from the head of the Delta, not from Bubastis, or Phacusa, as was the case with the earlier Canals thro' the Wadi Tumilat. The gain, however, from making the "off-take" of a canal from the head of the Delta, instead of lower down-stream, must have been a gain in volume of water only, not a gain in "head" or driving power. This latter, indeed, was not wanted & did not exist, because the upper parts of these Heliopolis Canals (p 19) ran alongside the Pelusiac arm of the Nile & upon the same plane, till it joined the Wadi Tumilat Canal proper

The "off-take" of the Wadi Tumilat Canals: p 19

It has been shown that near were Bubastis & Phacusa, on the Tanitic & the Pelusiac arms of the Nile respectively, joining each other by a cross branch & on the same parallel of Latitude or thereby. It is therefore only necessary to deal with the Phacusan "off-take" of these Wadi Tumilat Canals. That has been shown to be in the region of Saft el-Henna (pp. 60.61), & it is desirable to discover both the zero of this "off-take" and its high water levels. These can only be ascertained theoretically & yet with a fair amount of precision; for the regimen of the Nile

(regimen)

"Survey Dept."

"Tissot: Statistique de l'Egypte (1873)

and its deposit of Nile alluvium are really fixed quantities throughout the ages. Cf pp. 98. 99. We may, therefore set up a theoretical zero and a theoretical inundation level for a theoretical nilometer at Rhacusa or Saft el Henna thus: —

(1) The zero of the Roda nilometer is a theoretical figure. The new survey of the Irrigation Department of Egypt has slightly raised its level compared with that of Linant; & now it is taken at 12·5 metres above mean sea-level of the Mediterranean Cf Lyon: Nile p 321. Let it be put at 41 ft above that datum-level.

(2) The slope of the Nile in the Delta at Low Water is = 1/20,000 = 3·17 inches per mile: the slope for High Water = 1/13,000 = 4·87 inches per mile (Willcocks)

(3) The distance of Saft el Henna from the Roda nilometer is 50 miles

(4) The zero of our theoretical nilometer at Saft el-Henna, being 50 miles down stream on a slope = 3·17 inches per mile is 50 x 3·17 inches = 13·2 ft below the zero of the Roda Nilometer. Its height, therefore, above mean sea-level of the Mediterranean is 41·0 - 13·2 = 27·8 ft

Similarly we may discover High Water (inundation) for our Theoretical Nilometer at Khacasa (Saff el Henna) thus:-

(1) High water at Roda nilometer is = Zero Level + inundation rise = 41·0 + 23·5 = 64·5 ft above mean sea-level of the Mediterranean

(2) The High Water level of our Theoretical nilometer at Saff el Henna, being 50 miles down stream on a slope of 4·87 inches = 50 × 4·87 inches = 20·3 ft. Its height, therefore above mean sea-level of the Mediterranean is 64·5 − 20·3 = 44·2 ft

Hence, for our Theoretical nilometer @ Saff el-Henna:-

(1) Zero = 27·8 ft above mean sea level (Med)
(2) High water = 44·2 ft above mean sea level (Med)

Hence (3) Rise of the Nile at Saff el-Henna is =
44·2 − 27·8 = 16·4 feet

Hence of the Wadi Tumilat Canals during the inundation was thus on an average = 16·4 ft.

*N. B. The cause of the difference between the two seas in this respect is, doubtless, the attraction of the mighty Jebel Ataka in the region of Suez. The Indian Survey showed ~~that~~ the sea-surface is 300 ft. nearer the centre of the earth at Ceylon than at the Indus Delta, owing to the attraction of the Himalayas. Prof. Hull calculated ~~that~~ the sea-surface is 2000 ft nearer the centre of the earth at the Sandwich Islands than on the west coast of South America owing to the attraction of the Andes When Nero was engaging himself in the project of cutting thro' the Isthmus of Corinth, Egyptian engineers declared ~~that~~ the seas on each side were at different levels.

Alleged Difference of Level between the Mediterranean & the Red Sea.

Here are introduced & are notice by Aristotle (p 12) in connection with the Isthmian Canals (p) of Sesostris & Darius. This point has received little attention hitherto. No explanation of it has hitherto been attempted, this Army gives us precisely the value of this difference alleged of level as three cubits (p 17). The particular cubit used here is not mentioned, but presumably it is the common Egyptian cubit - i.e. "the public or carpenter's cubit" = 0·450 metre = 1·476 ft. Hence three cubits = 4·43 ft. The difference in the levels of the Mediterranean & the Red Sea is a fact. Linant Bey's repeated surveys, & the rectification of these by the international commission of engineers leave no doubt about it. Linant's figures are these:-

Low water in Mediterranean	0·00 ft	Cf Jackson: Hydraulic Works p. 184
High water in Mediterranean	1·25 ft	
Low water in Red Sea at Suez	2·43 ft	
High water in Red Sea at Suez	7·94 ft	

Hence mean sea-level of Mediterranean = 0·62 ft
Hence also mean sea-level of Red Sea = 5·18 ft
Hence mean difference of levels between the two seas became = 4·56 ft = 3 cubits +

* Ca. 4·4 inches per mile as against 4·6 inches per mile: i.e. a difference of 20 inches in a 100 miles!

* Of these marvellous drainage works in the oases of Khargah

This is a very surprising argument, yet it is one, no doubt, based upon an accurate survey. Prof. Breasted shows that Amenemhat III (1849-1801 B.C.) made a cadastral survey of Egypt. Captain Lyons shows that the ancient Egyptians had instruments of precision for taking land-levels — the instrument used being a right-angled isosceles triangle of wood with a plumb-line, used on a long wooden straight-edge resting on pickets. He also quotes Borchardt as showing that the Egyptians carried out levelling from the head of the Delta & the first cataract in connection with Nilometers which were built at very important towns. The average slope deduced from scales on these Nilometer works being 1/14,400 as against 1/13,700 of the Irrigation Service of to-day* Cf Lyons: Cadastral Survey of Egypt pp 51. 52. The engineers of Sesostris were therefore quite likely to find out a difference of three cubits between the mean levels of the two seas. In the engineers of Samos & in his own engineers, Darius was, no doubt, equally fortunate. The further bearing of this difference of level between the two seas will soon become manifest (p). Much more remains to be said here, did space permit

The Εὐριπος of the Ptolemaic Canal

† Two tides & counter-tides prevailed against each other many times a day. Cf Aristotle, Strabo, Pliny, Cicero, Mela.

Strabo relates that the Ptolemaic kings made clear the ἔυριπος of their canal (cf p15). Writers, almost invariably, translate this term ἔυριπος as sluice or lock. But Diodorus gives as precise equivalents for these the words θύρα and διάβρα-γμα. The ἔυριπος must therefore bear a different meaning. The original ἔυριπος was the channel between the island of Euboea & the mainland of Boeotia. The foregoing term then came to denote a tidal channel, or a strait beset with rocks. Such precisely was the outlet of the Wadi Tumilat Canal or rather the Nile-arm through the Wadi Tumilat before Ptolemy ii undertook to canalise it afresh. Some two centuries & a half intervened between his work & that of Darius i. No doubt, the Red Sea, which still extended so far, had flooded the mouth of the old Canal of Darius, making it fabulous: the tides themselves penetrating far up the Wadi Tumilat "at full & change of moon". The first thing to be done was to shut out the sea by em-bankments, so as to form a channel of the di-mensions of a ship-canal at the mouth of the Wadi Tumilat. This is what Strabo means by making the ἔυριπος .. κλειστος cf p15a

It is proper to go further & ascertain the slope of this

Canal lying between Phacusa = Saft-el Henna and Arsinoe-Cleopatris = Maqfar

(1) Rise of alluvium of Wadi Tumilat = 4·5 inches or 3/8 ft per century. Cf p103

(2) Interval between To-day & day of Ptolemy ii = 21·5 cent

(3) Rise of alluvium of Wadi Tumilat in 21·5 centuries (curves) = 21·5 × 3/8 ft = 8·1 ft.

(4) Zero of theoretical nilometer at Phacusa ut supra is
(a) To-day = 27·8 ft above the Mediterranean
(b) In Ptolemy's time = 27·8 − 8·1 = 19·7 ft " " "

(5) But this height of 19·7 ft is to be referred now to the Red Sea at high water, which is 7·0 ft higher than the Mediterranean ut supra

(6) Thus this height of 19·7 ft referred to high water of the Red Sea becomes = 19·7 − 7·0 = 12·7 ft.

(7) This height of 12·7 ft is spread over the whole length of the Wadi Tumilat Canal between Phacusa & Arsinoe-Cleopatris ut supra

(8) Slope therefore of the Wadi Tumilat Canal, referred as above to the Red Sea = 12·7 × 12/38 inches = 4 inches per mile.

Similarly it can be shown that with high water of theoretical nilometer at Phacusa, ut supra, = 46·2 ft above the Mediterranean (p108), this referred to high water of the Red Sea ut supra gives a slope for the Wadi

Jumelat Canal = 9·2 inches per mile.

The current on a slope of 4·0 inches per mile would be about 4 miles per hour; & the current on a slope of 9·2 inches per mile would be about 10 miles per hour. Such a current would make navigation difficult for Nile boats & large vessels

The διαφραγμα ΠΙΔΟΤΕΧΤΟΥ of Diodorus almost certainly denotes a lock-gate. Two of them arranged to open outwards towards the sea would permit free egress of the canalised river at the inundation & would offer little difficulty to the passage of vessels either way.

When the 'ΕΥΡΙΠΟΣ was left unprotected by a διαφραγμα, as above, the tidal waters must have penetrated the channel of the Wadi Jumelat to a very considerable distance. Take the extreme case of Zero at Phacusa & low water at Arsinoe, then it can be shown that the slope of the Wadi Jumelat becomes 6·2 inches per mile. When therefore the high water at Arsinoe rose to its full extent of 7 ft., the tidal waters of the Red Sea must have penetrated the channel of the Wadi Jumelat some 13 miles. Rozière & Lepère's maps show that the waters of the Red Sea could penetrate as far

as far as possible, the Red Sea waters would penetrate still far beyond Shaffat. Lepsius admits so much. Cf

Dimensions of the old Wadi Tumilat Canals.

Strabo gives 100 cubits as the breadth of Ptolemy's Canal & Pliny makes it 100 ft, with a depth of 30 ft. Cf pp. 15.17 Both probably think of the breadth at the water-line; but the foregoing figures are worthless, or almost so; as the breadth & depth of the old Canals must have varied with the ground thro' which it passed & with their different expenses & sand-drift at different places. Herodotus tells how Necho aimed at constructing a canal sufficient in breadth for two triremes to be rowed abreast (p 10) The dimensions of an Attic trireme, after Boeck & Graser, are:- Length ⏜ 140 ft: breadth at water-line ⏜ 14 ft; oars 62 of 14.5 ft in uppermost tier, 58 of 10 ft in middle tier, 54 of 7.5 ft in lowest tier; draught ⏜ 7 & 8 ft. One trireme with such a spread of oars would require at least a space of (6 + 14 + 6 =) 26 ft. Two triremes when rowed abreast would require at least 3 × 26 or 78 ft. The estimate of Pliny seems just, & that of Strabo is not far astray

The French Engineers of the Expedition found traces of the old Canals (Lemaire & Hakem's) in the Wadi Tumilat, showing a breadth of 60 & 80

Cf Macdaren, 50 m; Talabot 40-50 m;
Captain Newbold, 64-70 paces (=160-175 ft)

* Cf. Rankine's Civil Engineering

metres (Macaren) or 90 metres (Talabot). Even the Edalout, the remains of the old Canal, probably Hakim's, showed a breadth of some 50 metres. all traces were then greatly improved by the exceedingly fresh appearance of the banks & bottom of the old Canal in this region. Talabot remarks upon its irregular outlines & compares it with the regular works of the old canal in the region of the Wadi Rumilat; declaring that the former was purely Arabic, whilst the vestiges of the latter possessed the appearance & greatness & regularity characteristic of the ancient Pharaohs. cf Revue des Deux Mondes: Vol X (1855): p 487. This point is of further interest. cf p.

The engineering formulae proper to an ordinary canal are these: -

i Least breadth at bottom = 2 × greatest breadth of boat
ii Least depth of water = 1·5 ft + greatest draught of boat
iii Least area of water-way = 6 × greatest midship section of boat

But it is evident that these formulae are not here applicable; for the old Wadi Tumilat Canal was essentially a river, subject to a periodic rise of some 16 feet at least (p 105) & the depth of the canal must have been such as to keep the Nile flood, flowing steadily, within the limits of its channel

N.B. The Khalifh Haroun er Rascheed wished to unite the two seas & an Isthmian canal to be supplied with water from the Nile, but gave up the idea, as this (impracticable) scheme would involve too great a loss of Nile water. Cf Quatremère i. 176

Were the Wadi Tumilat Canals Perennial or Seasonal?

No history exists on the subject, but certain considerations would indicate that these canals were navigable for some four months only - two on each side of the maximum rise of the Canal:-

(1) A canal which would be navigable for sea-going vessels would require a supply of water little less than that of any of the seven branches of the Nile flowing into the Delta & the Mediterranean. Such a supply would mean the cutting off of the Pelusiac arm of the Nile, as happened at the opening of Lemaire Canal. Cf p.

(2) Even if a supply of water were available, problems about sluices, locks, &c present themselves here, which would probably have been beyond the skill & the resources of Egyptian, Persian, & Greek engineers; not to mention the Arabic ones.

(3) Even if such skill & resources had been to hand, the gains accruing from such a perennial canal would have found been poor compensation for the vast expenditure involved in repairs, working, &c

(4) The Wadi Tumilat Canals were always of secondary importance to Egyptian commerce foreign, which usually preferred to use the Nile route to upper parts of Egypt, one of the wadis between the Nile, & some Red Sea port. The latter canals were used

almost entirely, if not altogether, for the import of elephants & stones.

With considerable assurance, therefore, we may dismiss the idea that the Wadi Tumilat Canals were available for navigation for more than four months in the year. Navigation of the Wadi Tumilat Canal, at or about the time of the inundation, as indicated by the return of the fleet of Tothmes III about October, as already mentioned. Cf p. 52a

History of the Four Ancient Canals.

It is enough to deal rightly with this part of our subject, as detailed history is clearly out of the question in this regard, tho' the historical situation always requires close attention:-

1 The so-called Canal of Sesostris.

The name of Seti I has been associated with this Canal on the authority of Brugsch, who interpreted on this wise Scene 9 on the northern wall of the Hypostyle Hall of Karnak. There Seti is depicted as returning by the fortress town of Zalu from

his first campaign in Syria. He crosses "the cutting" - "Ta 'denat", which separates Egypt from the desert, & a bridge. The stream underneath swarms with fishes & crocodiles. Brugsch, therefore, regarded this stream as the canal uniting the Red Sea & the Mediterranean. His view has gained wide acceptance & appears in Prof. Petrie's History of Egypt: vol iii p 13. But this fortress town called Zalu - the Sile of the Antonine Itinerary - has now been identified by excavation & inscriptions, - as Kantarah, "the Bridge", at the 45th kilometre of the Suez Canal (Naville: Archaeology) pp 38-39. Even this bridge have surged invading & conquering hosts from the times of Thutmes iii of the 18th dynasty down to the attempted encirclement of the Turks in February 1915. The canal of Seti so-called thus turns out to be the Pelusiac arm of the Nile which ran thru Zalu-Sile. It has nothing whatever to do with a marine canal between the Mediterranean & the Red Sea. That would have been, as now, a salt-water canal. As such it would have contained no crocodiles, which are anything but salt-water animals. Among reptiles of this order, only the Croc. biporcatus ventures at times into the sea. That fact alone should have prevented the idea of the canal at Zalu being a canal between the two seas. This canal

or "cutting" may be the Sichor of Scripture - the Horus-Sei a Horus Lake of the ancient Egyptians. Cf. Rouge La Basse Eg. pp 93. 95. 101

The foregoing, however, settles nothing about the Canal of Sesostris. Herodotus does not mention his name in connection with any Canal in particular, tho' he has much that is fabulous to say about him otherwise. Many regard the "Sesostreus fradidum" of the Wadi Tumilat canal as post-Herodotean & probably it is so. But who is this Sesostris of Aristotle, Diodore, Strabo, & others?

There are three kings of this name belonging to the XII^th dynasty - each of them great as conquerors, rulers, & organisers of the resources of Egypt. They all carry on important works in Lake Moeris in the Fayum. Amenemhat III^d brings there to a highly successful conclusion & sets up the earliest nilometer at Semna by the second cataract. Prof Petrie shows that kings of the 12^th dynasty had relations with establishments on the site of Tell el Retabeh. Lieblein has gone so far as to assert that Amenemhat III^d canalised the Wadi Tumilat. But this may well be doubted, as the earliest name-lists - those of the reign of Seti I - show that the name of Lower Egypt end with the Heliopolite name. The Wadi Tumilat,

* The late Sir George Sharpe has shown how Ramses II becomes the Sesostris of the Persian Period and the Osymandyas of the Ptolemaic Period
Cf Popular Stories of Ancient Egypt pp 180...

was not organised as a monument the time of Seti I. But his son Ramses ii lauds both Raamses-town & Pithom in the Wadi Tumilat. The poem of Pentaera shows that the former is a garden-city, the seat of government, and a sea-port (p). These things agree well with the canalising of the Wadi Tumilat of Ramses ii, whose name is Sheweser Sesôstris - a name of Memphite origin, after his popular name Sesuriya, found on several monuments.

Whilst there is good reason for connecting the name of Ramses ii as Sesostris with the Wadi Tumilat Canal, Aristotle connects this name with what is distinctly an Isthmian Canal, & connects the two seas. There is excellent reason for supposing that this Sesostris is again Ramses ii. After making peace with the Hittites in his 21st year, he had the leisure, the man-power, & other resources for accomplishing such a scheme, which [which would give direct access] would greatly benefit his kingdom, both from the military & the commercial point of view. The excavation offered no insuperable difficulty. The line of the proposed canal would run mostly through Nile-alluvium. But the survey showed the Red Sea to be higher than the Mediterranean, higher than the low-lying areas of the Delta. The project thus went no further

The Northern or Isthmian Canal failed & material-
ise

ii The Canal of Necho ii (610-594 BC)

Very much could easily be written about him, were this the place for it. He was an ambitious son of an ambitious father. Both had developed the naval & military forces of Egypt with the aid of the Greeks. As Nineveh, the capital of the Assyrian kingdom, was now hastening to its fall, Necho lost no time in setting out his expedition to Syria, 609 BC. Sweeping, Josiah, King of Judah, from his path, he overruns Northern Syria as far as the Euphrates & returns to Egypt in triumph after a few months absence. There are many & strong reasons for believing that Necho went to Syria by sea & not by land, but these cannot be advanced here. It is almost certain, as a sequel to such a course, that Neco took Gaza on his return from his northern campaign Be that, however, as it may, Necho must have returned with a vast multitude of captives, & it is altogether likely that the digging of his canal began upon his return, with the help of these numerous prisoners of war. The canalisation of the Nile-arm thro' the Wadi Tumilat was thus probably quite a small matter & soon accomplished.

† The invasion took place in the 37th. year of Nebuchadnezzar: attested by Prof. Sayce's cylinder: cf Academy XXV (1884) p 57 Nesuhr, governor in Upper Egypt, under Apries, who quells a revolt of Egyptian troops (this has nothing to do with Nebuchadnezzar

Cf Alexander of Macedonia (says the Jews of Jerusalem in a temple or pavilion called Tetrapylon at Alexandria.

Necho's connection with an Isthmian or Northern Canal remains a matter of speculation. Herodotus couples his name with such an enterprise, making him attempt a water-way from the Pelusiac mouth of the Nile to the Arabian Gulf or Red Sea (p 13) Herodotus speaks of him as lordly fleets upon both the Mediterranean & the Red Sea. Necho had evidently great commercial schemes in hand & a canal between the two seas is not unlikely. But its execution is arrested: by an oracle, according to Herodotus: by his defeat at the hands of Nebuchadnezzar in the battle of Carchemish on the Euphrates, 605 BC., according to Wiedemann & many others. Nevertheless, there seems to be much truth in the account of Herodotus; for the oracle is, in all likelihood, the oracle of the prophet Jeremiah, who twice prophesied the invasion of Egypt by Nebuchadnezzar. Cf Jer. XLIII-8-13: XLVI-14-16. This may seem an adventurous proposition, unless we bear in mind the fact that Jeremiah's personality had assumed an international importance during the siege of Jerusalem & at its fall in 586 B.C. He was held in highest esteem by Nebuchadnezzar & his subsequent prophesying in Egypt (at Tel Defenneh: Cf) against Egypt seems to have been well remembered in Egypt itself. But in this supposed citation of Jeremiah & the "oracle" of Herodotus, no others is here laid.

+ The Hykshos at Avaris number 240,000 : Jos. c. ap. i § 14
so do
the Asmah (Herod. ii. 30; whilst the impure
Israelites number 250,000 cf Jos. C. ap. i § 32

The "nacle" would have great cogency, if Neco were at the time of its delivery engaged in an Isthmian or Northern Canal; for its completion would have been of great advantage to Nebuchadnezzar, as further laying Egypt open to attack from the Northern or the Southern Sea

The testimony of Herodotus as to the death of 120,000 men in digging a canal is probably an exaggeration in point of numbers. Indeed 240,000 is rather a conventional figure in the history of ancient Egypt, & this 120,000 is a sub multiple of it. In 1819 Mehemet Ali set 250,000 peasants to work on the Mahmudeah Canal. Its length was about 50 miles, its average breadth about 100 ft. The work continued about a year & the people who perished by accident, hunger, & plague numbered not less than 20,000. Necho might have 120,000 men on the Northern or Isthmian Canal. The work done is nearly equal to that done on Ali's Canal & the number, who might have perished under conditions, ut supra, should not have been more than some 10,000. If anything like the number mentioned by Herodotus, perished, then we might reasonably suppose an outbreak of Oriental fulminic. The region round about Lake Serbonis had a bad reputation in this respect & the Scythians who

* Something of this sort may underlie the report of Herodotus regarding the omitting of Hera's Skythes by Celestial Venus. i. 105. The account of Hippocrates regarding the Enarees of Herodotus may in part corroborate the foregoing view. Cf

Cf Herod ii, 141 Lauriault

attempted an invasion of Egypt in the time of Necho's father may have retired from the frontier plague-stricken,* without the gifts & prayers of Psammetichus, as Herodotus asserts (ii.105). The Herodotean account of the disaster which befell Sennacherib in the region of Pelusium may also point to plague, as indicated by the mouse in the hand of the priest of Vulcan so-called (ii. 141). All that one can conjecture here is, that if Necho suffered the loss of even 10 per cent of the number of men set down by Herodotus, an outbreak of plague may be suspected as the cause. Such a cause was likely to operate in the region of L. Serbonis or Pelusium & in this region Necho may have been attempting an Isthmian Canal.

The Canal or Canals of Darius: 521-485 B.C.

i The Wadi Tumilat Canal. This is the one specially described by Herodotus. Remembering that the work here is simply the repairing of a canalised river, in the dry season, such repair was a simple matter. There need be no hesitation whatever in accepting the statement of Herodotus as to its completion; all the more that he visited Egypt some 30 years after the death of Darius, during the inundation ⊆ 455 B.C.

ii The Southern Canal. This was marked out by imposing stelae, bearing the figure of Darius with inscriptions in four languages - Egyptian on one side, with Persian, Median, & Assyrian on the other. The detailed history of the discovery of these monuments cannot be given here. Suffice it to say that they were found more or less along the line of the present Fresh-water Canal going from the Nile to Suez. Their relative positions are these, so far as yet ascertained:

(1) The Tell el Maskoutah (Pithom) monument, one kilometre south of Tell el Maskoutah
(2) The Serapeum monument, at the 14" kilometre on the Fresh-water Canal
(3) The Chalouf monument, at the 61" kilometre on the Fresh-water Canal. (12 kms from Chalouf)
(4) The Suez monument, at the 83" kilometre on the Fresh-water Canal. (7 kms north of Suez)

No one has hitherto noticed that these monuments are symmetrically disposed. Thus:-

(1) Distance between the Tell el Maskoutah monument & that of the Serapeum ≤ 23 kms
(2) Distance between the Suez monument and that of the Chalouf ≤ 23 kms
(3) Distance between the Chalouf & the Serapeum monuments c 2×23 kms

Tell el Mashkhoutah Stele *

Serapeum Stele	14 km	on the Fresh-water Canal
Devéria Stele (?)	37 km	" " " "
Chalouf Stele	60 km	" " " "
Suez Stele	83 km	" " " "

986

* The first Tell el Mashkhoutah Monument.

The last stem points to the probable or certain existence formerly of a monument half way between the Chalouf & the Serapeum Monument. This becomes even so much more probable when we remember that 23 kilometres closely represents the average distance between the post-houses on the great highway from Sais, past Sardis, to Ephesus, is between 14 & 15 miles. Cf Herodt IV. 52. These represent some four parasangs. The symmetry of the distribution thus calls for a stele. Now Rozière discovered & in part deciphered a stele, now lost, which once stood at 6·5 hrs north of Suez. But this 6·5 hours' journey on camel-back is again between 14 & 15 miles or 23 kilometres. Here, Maspero, near the Fresh-water Canal may this last monument still be recovered: this being apparently that which was seen & also lost by Devéria during the time of the French Survey here.

Of the four monuments, whose sites are known, that near Suez has long been reduced to fragments, that of Chalouf has been reduced to powder; that of the Chalouf & that of Tell el Maskhoutah are in fragments, from which only the sublimest patience & genius have been able to exhaust any information about this Southern Canal. The Chalouf Stele, such as it is, has been carefully studied. It was inscribed in four languages - Egyptian, (hieroglyphic), Persian, Median, & Assyrian. The Egyptian occupied one

side, the other three languages the other. The Egyptian was translated by Maspero, the Persian by Oppert, the last lines of the Median text are defective, & those of the Assyrian text is altogether wanting. Oppert's translation denied outright the completion of this canal. Its cuneiform part thus runs: "Darius the King says" I am a Persian, with the aid of Persia, I conquered Egypt. I ordered this canal to be dug, from the River named Pirava (Nile), which flows in Egypt, until the sea which is in communication with Persia. Then this canal was dug thus as I ordered it. But I said thus: Now go & destroy the half of the canal from the town of Bira, until the sea, for thus is my will"

Cf Records of the Past: IX pp 80.81 (1st series)

The whole subject has been studied afresh with the most excellent results in the "Recueil de Travaux"

(1) G. Maspero: VII. pp 1-8 (1886)
(2) J. Ménant: IX. pp 131-157 (1887)
(3) G. Daressy: XI. pp 160-171 (1889)
(4) H. Solmsschess. XII. pp 99-109 (1890)

Without entering into particulars, it is now well known that Oppert simply inserted the letters which, in the cuneal part, denote - destroy - & the word Bira

Atyâtâ haca [Bira]ya [nai] mami
Ite inde a Bira dimidium

yuviyam abiy pâ [ram · viha] ta
canalem usque ad littus dirvite

Maspero, Navelle, & others could find nothing like Bira in the debris of the text. Maspero could find only the ending of a mutilated phrase - "When they reached Piri ... water" He regarded Piri as uncertain but was tempted to read Piris, Pirs, Pirsi - which might be Persia. Oppert simply introduced the critical term [viha] ta = "destroy" : the cuneiform text having here a lacuna followed by the letters ta Ménant, after many forceful remarks upon Oppert's venture here - [viha] ta - shows that Oppert's intruded letters viha - do not even fulfil the space requirements of the text. Dismissing Oppert's embellishments, he would read the disputed line simply "Allez à partir de ... ce canal jusqu'au littoral, telle est ma volonté." In conclusion, he applies to the line under consideration the foaming words - Parcourez la totalité de ce canal jusqu'à la mer : telle est ma volonté

Darmesty in his "Révision des textes de la Stèle de Behistoun", after some interesting suggestions, holds the completion of the Canal of Darius as proven: founding on Line 3 of Fragment No. 9 : - "Ils arrivèrent en Perse en prenant (?) l'eau" ; which

formula Darius understands, as denoting a voyage to Persia"
In any case, he finds nothing in the hieroglyphic texts to
support a check upon the undertakings of Darius

Sölenischeff deals with the last discovered Stele - that
at Tell el Maskhoutah He finds twice in the text
a reference to Shaba - land of the Sabaeans in South
Arabia & finds Darius despatching a fleet to
reconnoitre the sea. He too believes in the completion
of the Canal of Darius

Conclusion. There can now be no reasonable doubt about
the completion of what we have, for convenience, called
the Southern Canal of Darius. The contents of the
Stelae, thus far, agree well with the last details of
Herodotus, viz - the voyage from Caspatyrus (Cabul)
in India to the Hieropolite Gulf - & Athens there. The
Southern Canal seems indicated by Herodotus in
two things: (1) its turning south & south east into the
Arabian Gulf (2) its length as equal to a four days'
voyage (cf p 10). His account otherwise refers to
the Wadi Tumilat Canal

iii" The Isthmian or Northern Canal. Such a canal
would readily commend itself to one of the most
successful rulers known to history. He had at his

disposal abundance of men for such an enterprise, with skilful engineers - Egyptian, Persian, & Greek (from Samos). The excavation was not great in amount; but the discovery of the difference of level between the two seas put an end to the project. Herodotus, in the most explicit & exclusive manner, deals with this Dathmian canalization.

The Canals of Ptolemy ii: 285-247. BC.

(1) The Wadi Tumilat Canal. Its completion is beyond doubt. Its termination at Heroonopolis (Magfar) is certain according to the testimony of classical writers. There is also the testimony of the Pithom-Stele, or, as Naville, its discoverer calls it - the Stone of Pithom (p 18. ed. 3rd). Since his translation of this document, we have the translation of Brugsch; & now the revised version of the latter by Erman (Zeitschrift für ägy. Sprache: Bd xxxii. (1894). It attests the opening or repairing of the Wadi Tumilat Canal by Ptolemy ii in his Sixth year (pp 78-79); followed by an expedition to Persia for bringing back the lost gods of Egyptians. Next, however, in his Sixteenth year he digs his Heliopolite Canal which ends in the Serapeum Lake. In the same year he founds the city of Arsinoe in honour of Arsinoe, his sister & wife; she having died in the previous year. Now comes the fitting out

of a fleet of transports from Kenoverma (= Magnapolis) for hunting elephants. Bouché-Leclercq has, with rare insight, disclosed the secret of this movement. Antiochus was preparing war against Ptolemy ii, but dissimulated his preparations. In the course of the year 275-274 BC, Antiochus got 20 elephants from Babylon & Seleucia, & other things. In the spring of the year 273 he sets out with his army & Egypt. The Rhodian-Stele says that on his XII^th year, Ptolemy, with his sister Arsinoe, came to Heroopolis & took upon the defences of Egypt on that quarter, also & inspected & hasten on the canal for the fleet upon the Red Sea, if need should arise. War was not yet declared. In the year 273 Ptolemy sends an embassy to Rome & receives one in return from Rome. At this juncture war was declared [by the Romans] against between the Kings of Syria & Egypt. Now comes the expedition to the land of the Troglodytes for elephants to be trained for war: Ptolemy being cut off from a supply from India. The Rhodian Stele evinces a certain anxiety about the supply of these elephants. The King tried to persuade them Troglodytes to give up their taking of elephants that he might have more for war; but the Elephantophagi refused to change their habits, even for all the good things of Egypt. The history of the war-Elephants, both before & after Ptolemy's day, is an interesting story, which must here remain

cf Hist. Roman: Proem 10.

* Roughly 208-206 BC. Classical Review XII (1898)

unfounded. Appian makes Ptolemy ii the possessor of 300 war-elephants - an obvious exaggeration. The import of elephants from the south continued until at least the reign of Ptolemy Philopator, as Hall has shown. Cf Classical Review; pp 274-276. Strabo gives a long list of places where elephants were hunted by the Ptolemies, even from Ptolemais Theron, just founded for this purpose, almost up to Cape Guardafui. Strabo. xvi. iv. 5-15.

ii The Heliopolite Canal. This is the old Egyptian canal of the Heliopolite nome called A-ti or A-i or Mui, which watered part of the Arabian nome. Cf Rougé; de Basse-Egypte pp 4. 82. 140. It joined the Wadi Tumilat Canal in the neighbourhood of Bubastis.

The Canals of Ptolemy proved of little worth for general commerce & at a later date he fitted up Berenice on the coast of the Red Sea as a port joined to Coptos on the Nile by a good road, well supplied with water. Cf Strabo. xvii. i. 45. The Canals were a necessity for the importation of elephants, & Diodorus shows how the elephant-transports often came to grief through stormy seas. Cf Diodor. iii cp 40.

Trajan's Canal: 98-117 A.D.

cf Revue des deux Mondes: xxvii. pp 215-235 (1842)
cf Recueil vol i pp 136-197 (1842)

This, as noted, is Ptolemy's Heliopolite Canal, joined to the Wadi Tumilat Canal. Ptolemy's statement concerning it is most concise, yet most meagre. Makrizi ascribes the construction, i.e. the repairing of this Canal with the name of Hadrian. That Trajan had a plan on hand, & that Hadrian executed that plan, is the idea of Makrizi & very likely in itself. Anyhow, there is good reason for viewing & accepting the view of Gregorovius, based ultimately on Humboldt's Kosmos (ii p 204) that Trajan had before 109 A.D. not only restored the canal from Bubastis to Arsinoe, but had also made a branch to Babylon. Cf Gregorovius: "The Emperor Hadrian" i. p 131. His reign ended in the disaster of defeat at Ctesiphon & his death followed close upon it. Cf Dio Cassius: Bk 68 ch 32. The canal was probably constructed shortly after the death of Trajan (in 117 A.D.). How this water-way was used for the importation of Porphyry & Granite from the Hebrand has been already noted & reasons have been given against the view that this Canal was silted up, at least definitely, by the time of Septimius Severus, c 205 to 209 A.D. Strabo has dealt very fully with these quarries for porphyry & granite at Gebel Dokhan & Gebel Fokkerah respectively. These quarries for porphyry continued in use till the time of Diocletian, as Eusebius shows. The Thebaid poem of Paulus

Silentiarius describing the building of the Church of St Sophia in Constantinople might be taken to indicate the closing of Trajans Canal at or before that time, as porphyry is now described as being imported by the Nile

Ὅυς ποτε Θηβης νειάθης ἐδοχευσαν ἐυκνημιδες
Ἐρίπται Description: l. vv 379. 380
πολυς δ' ἐυπαχεϊ νειάθι φορτίδα πιδησας
πυταμηίδα δαας ἀνιόχων πορφυρεους V. 625-627

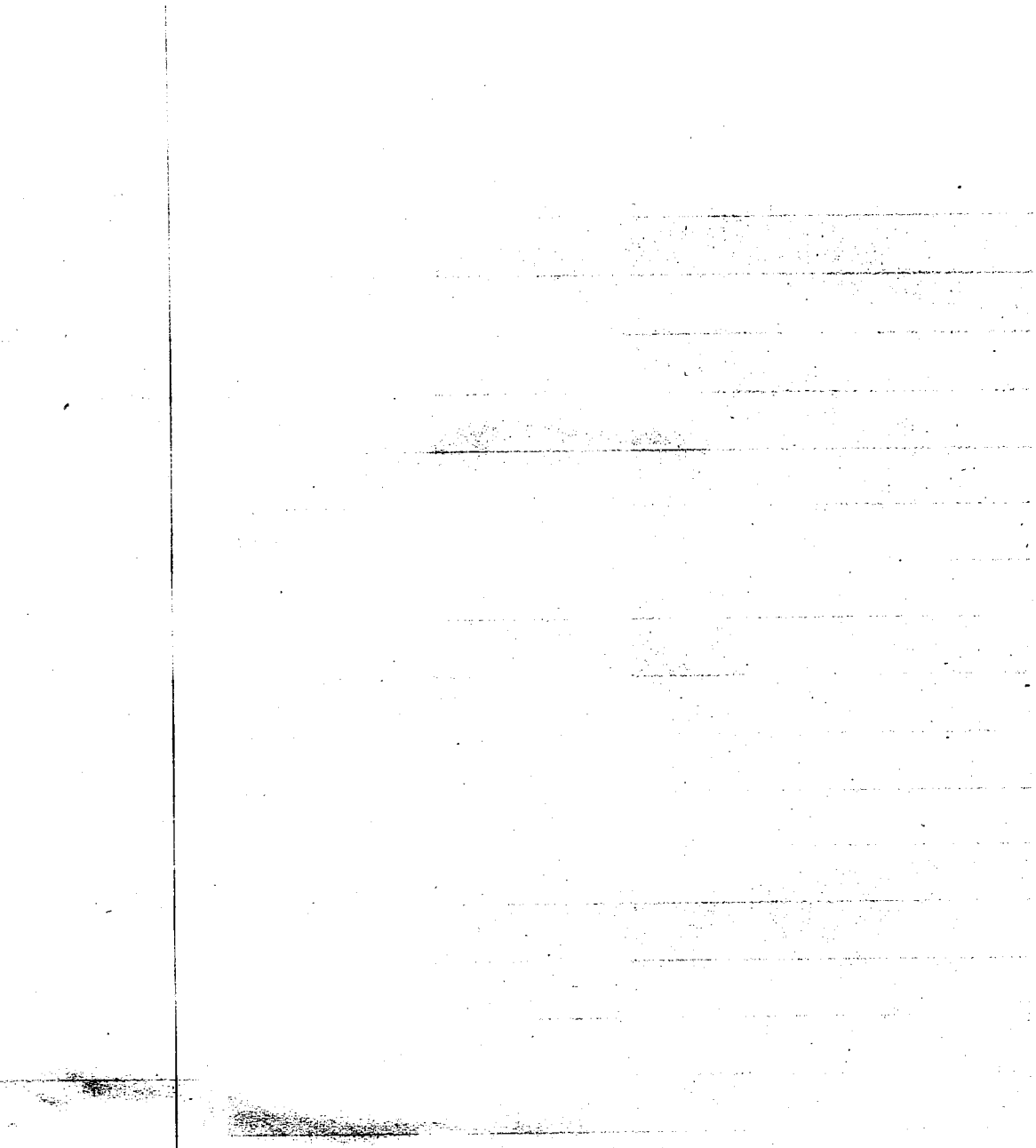
Yet the porphyry used was not all directly brought from the Nile bed. Gibbon knows that eight columns of it were taken from a temple of the sun dedicated by Aurelian. It is impossible now to retake the journey of Wilkinson & Burton to these quarries (cf Jo. Roy. Geogr. Soc ii p 42 ..) nor the recent survey of these by the members of the Egyptian Survey Department. There is excellent reason for believing that Trajans Canal continued in use, till closed by the Coptic Christians as a defence against invasion from Arabia, at the time of the rise of Islamism Cf p. 90.

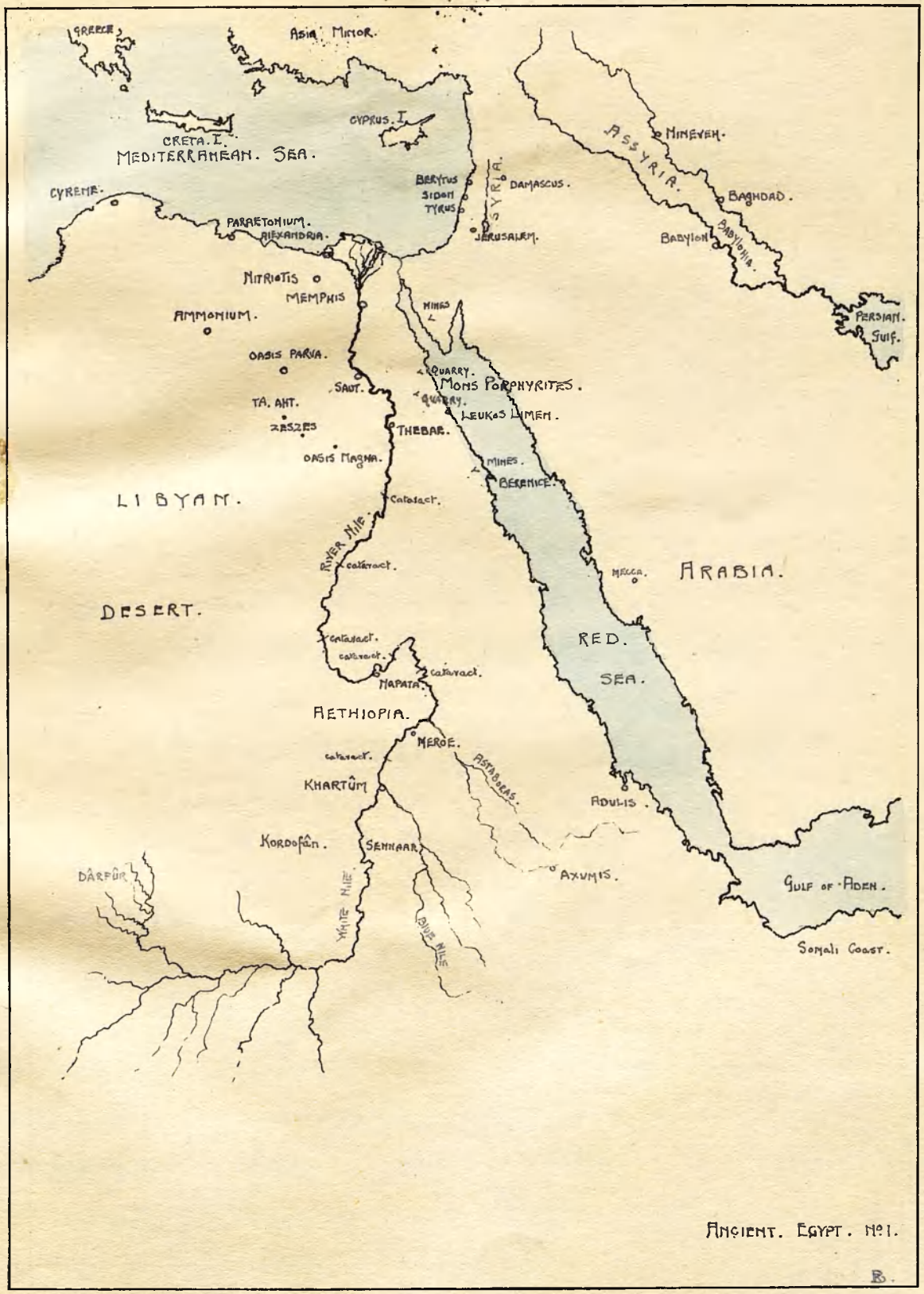
The Canal of Omar: 634-644 A.D

This may be very lightly dealt with, as having been already described: —
i Omars Canal is Trajans Canal restored.

This is the statement of all the responsible Arabic geographers
ii This Canal ends in the region of the Wadi Tumilat:—
(1) It ends at the place called the Jaul of the Crocodile. So
Al-Kindi & Ibn abdul Hakim Ibn el Heseyr. This, as already noted,
is the western extension of Lake Timsah up the Wadi
Tumilat. (2) Ibn el Heseyr makes Omar's
Canal begin at the Sea of Sweet Water (Nile) & end
at the Sea of Salt Water, at Kulzum, which, as shown,
already recalls the more ancient Northern Clysma.
So also Makrizi & Schems Eddin.

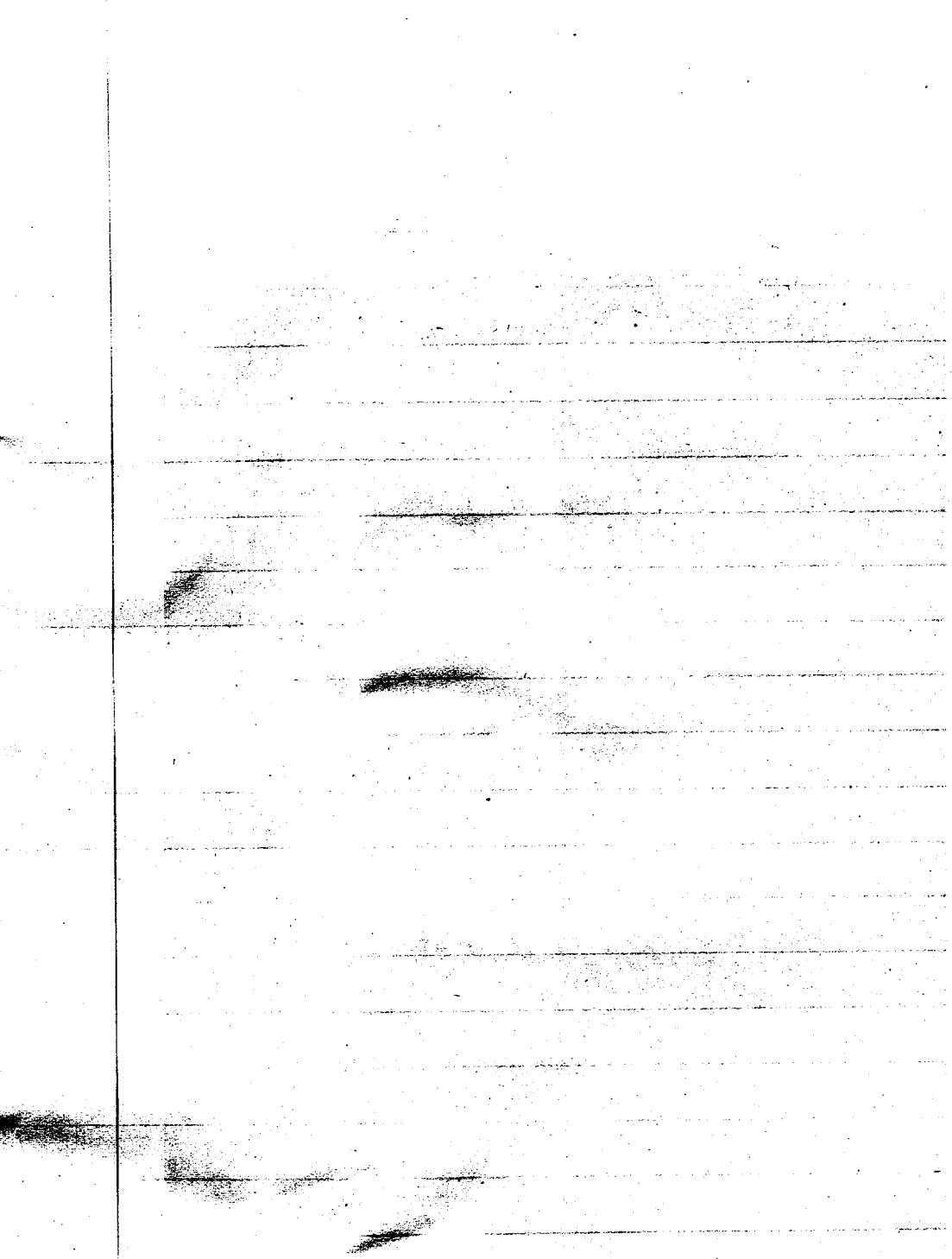
The continuance of this Canal until about 1350 A.D. has
been already indicated. Cf p 93.



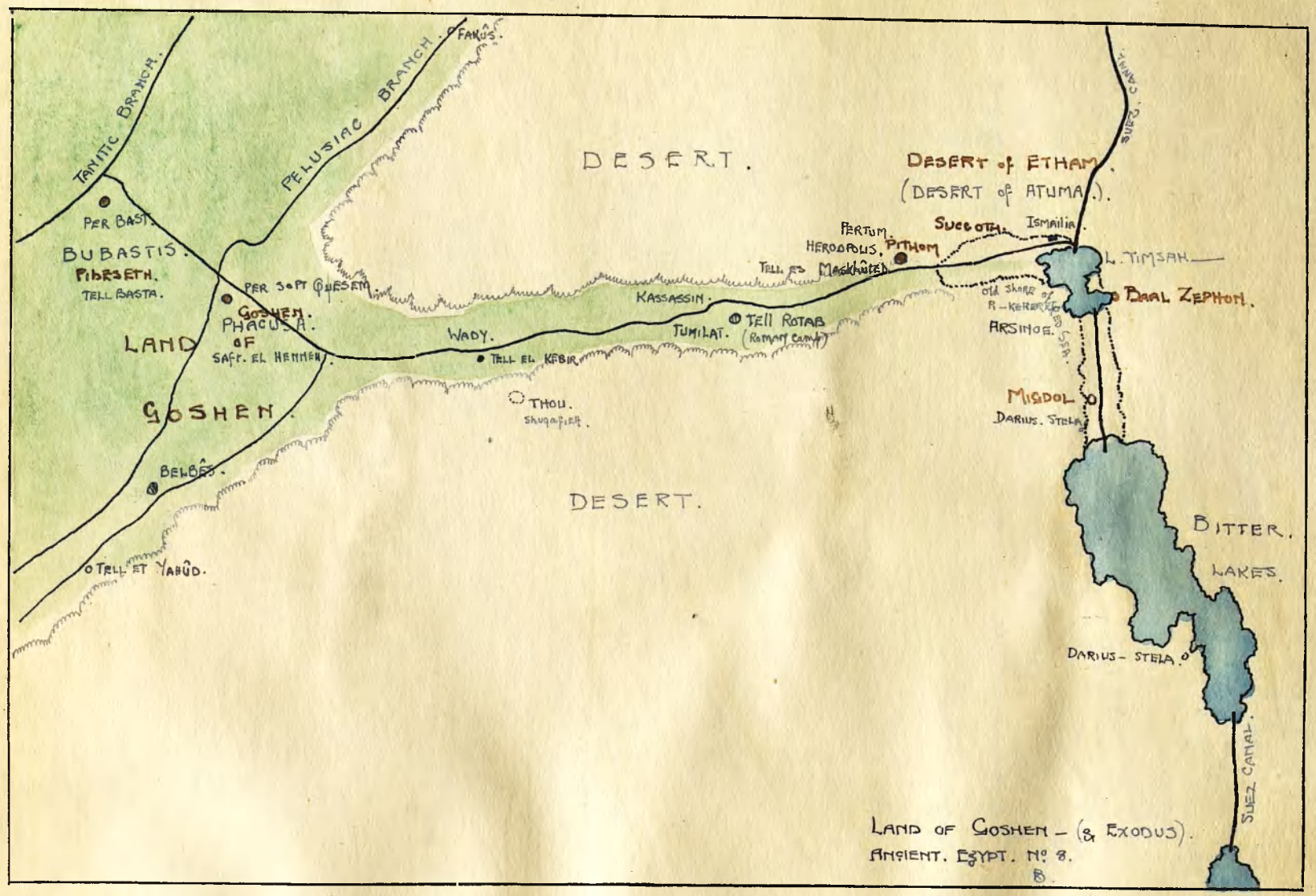


ANCIENT. EGYPT. No 1.

B.




MEDITERRANEAN SEA.
SEBENNYTIC. Mo.
PHATNITIC. Mo.
Bolbitine. Mo.
Sand. hills.
SAND. Hills.
DUMYAT (DAMIETTA)
L. BURLUS.
ER RASHID. (ROSETTA).
PACHNAMUNIS.
MENDESIAN. Mo.
TANITIC. Mo.
CANOPUS.
ALEXANDRIA.
L. EDKU.
METELIS.
CABASA.
XOIS.
R. MILE.
LAKE.
MENZALEH.
Mt. CASIUS.
LAKE MARIOTIS.
HERMOPOLIS PARVA.
ISEUM.
HERMOPOLIS.
Pelusiac. Mo.
LAKE SERBONIS.
SIN.
PELUSIUM.
MIGDOL.
SERRHA.
MENDES.
TANIS.
ZOAN.
ANTHYLLA.
SAIS.
NAUCRATIS.
AMU.
PHARBAETHUS.
DAPHNAE.
TAHPANHES.
HORBET.
DESERT.
PELUSIAN ARM.
PHACUSA.
BUBASTIS.
TELL TUKH.
PERTUM.
HERÔPOLIS.
PITHOM.
TELL EL MASHUTEH.
L. TIMSAH.
TELL. ROTAB.
PROSOPIS.
PIBESETH.
GOSHEN.
TERENUTHIS.
ATHRIBIS.
MATRON. LAKES.
BELBES.
TELL ET YAHÛD.
TELL ET YAHÛDIAH.
ONIAS.
HELIOPOLIS.
BITTER. LAKES.
DARIUS. STELA.
LETOPOLIS.
ON.
MASR EL KAHIREH. (CAIRO).
BABYLON. (KHER AHAU).
TURRA QUARRIES.
PYRAMIDS.
DARIUS. STELA. CIYSMA.
MEMPHIS.
NOPH.
SUEZ.
APHRODITOPOLIS.
L. MOERIS.
GULF. of. SUEZ.
ANCIENT. EGYPT.
No 3. B.

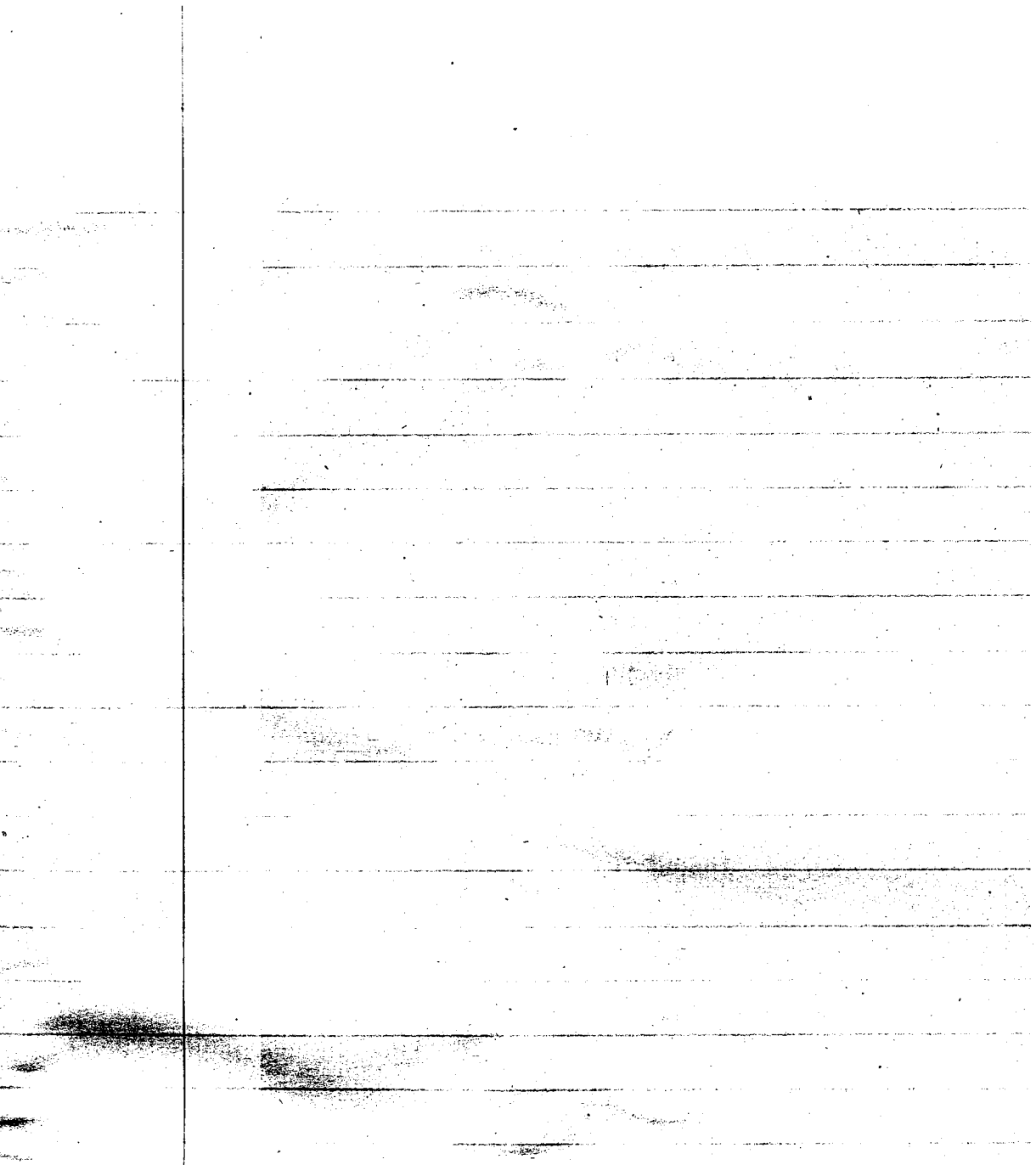


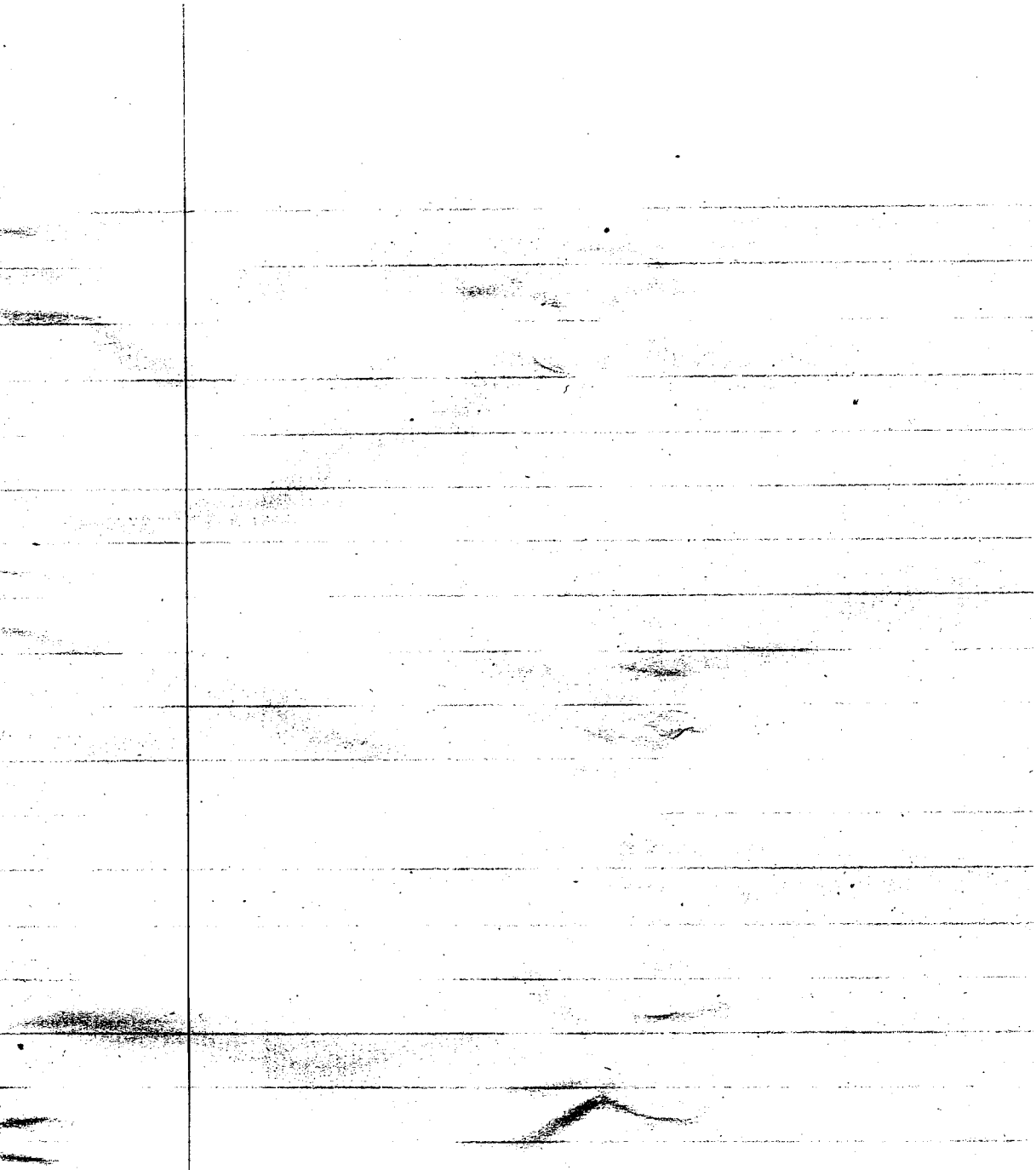
LAND OF GOSHEN – (& EXODUS).
ANCIENT. EGYPT. No. 8.
B.

EGYPTIAN DESERT.

KENEH to SUEZ. B.

C 141a





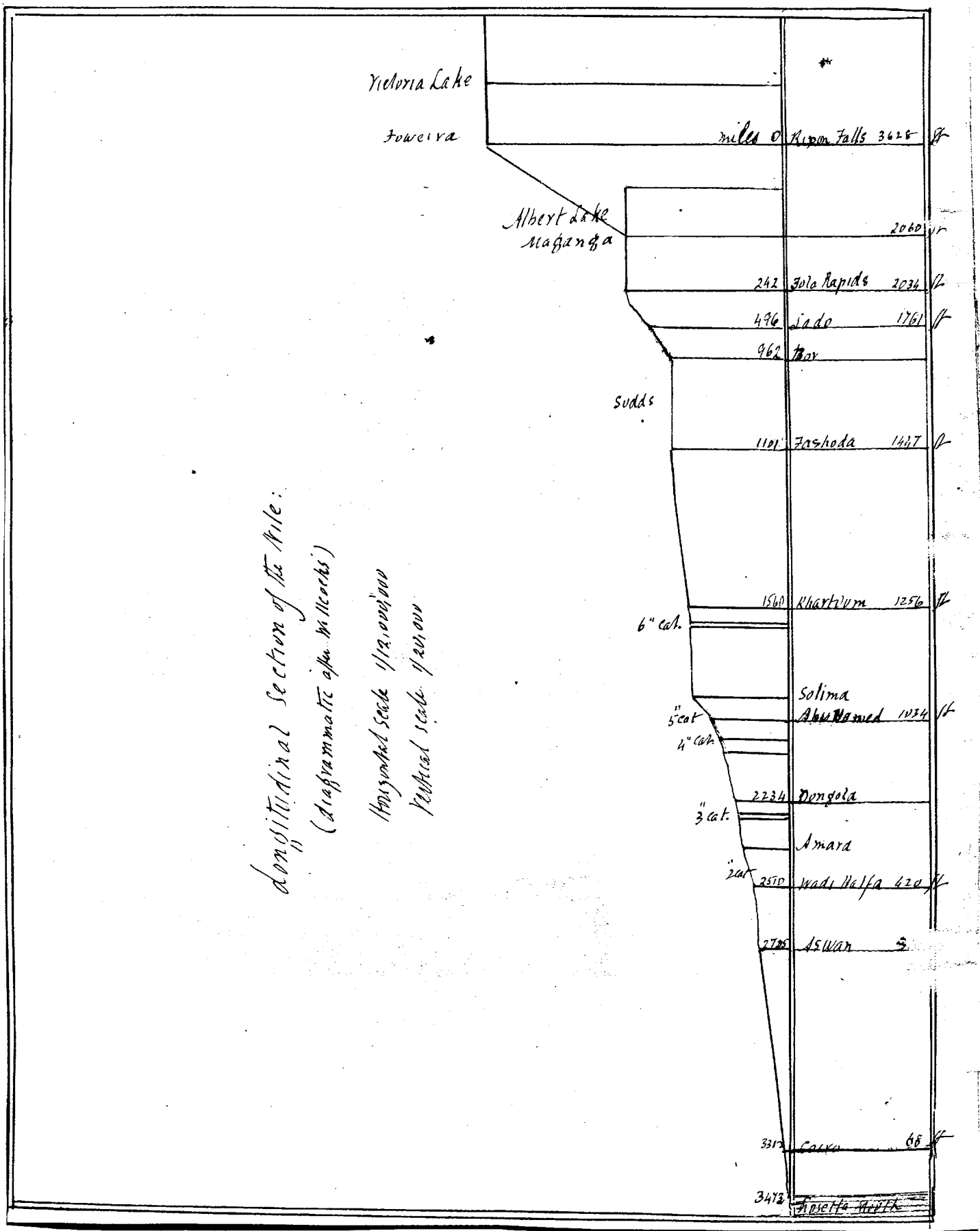
MER. MÉDITERRANÉE.

Bas Bourlos.
Embc. de Bourlos.
Embc. de la Branche de Damiette.
Embc. de la Branche de Rosette.
Beltim.
L'achetoum.
Damiette.
Lac de Bourlos.
Rosette.
Bay d' Abou-kir.
Berimbal
Dibeh
B. de Dibeh.
B. de Gemileh.
B. d'Oum Fares.
Golfe. de Peluse.
Ruines de Canope.
Alexandrie.
Lac d'Etko.
Deirout
Fouah.
Terres incultes
Kasr Shek.
Deffrieh.
Chrisine
Phacitique.
Lac Menzaleh.
Menzaleh.
Baie de Timeh.
Birquet Mariout.
Ancien Lac. Maréotis.
Canal d'Alexandrie
Ramanieh.
Calline.
Ancienne Bras Mendesienne.
Mansourah.
Fort de Timeh.
Peluse.
Damanhour.
Ancienne Branche Canopique
Bahr Schelifeh
C. de Kasr Shek
Mahallet-el Kebir.
Samanoud.
Ruines de Tanis.
Sane.
Nieleh.
Ancien canal de Mariout
Canal de Bouhie.
Ancienne Branche Tanitique
Salieh
Bibanè Bouline
Naqiuler.
Tantah.
Horbeit.
Lac. Ballah.
Ancienne Bras Pelusiaque.
Ziftch
Amit Camar.
Lac Menzaleh
Karaun
Ouadi Toumilat.
Ruines de Bubaste.
Nouveau canal suivant l'ancien.
Abou Rackraus.
Lac. Timsah.
Ras ouadi.
Abou Nechabie.
Haouarni.
Vestige de l'ancien canal de Suez.
Ruines de Serapeum.
Bulbeis.
Zaouamel.
Bassin des Lacs Amers.
Mon. Perisepolitain.
Vestige de l'ancien canal
Ruines.
Suez
Tairieh.
Chibin.
Berbeh
Macir.
Terranieh
Chemout.
Degouen.
K. Abbas
Chaine de Lybie.
Barrage du Nile.
Om. Dinar.
Kankah
El Kaleg.
Hobasieh.
Boulak
Le Caire.
Gizeh
Vieux Caire.
Montagne du Moqattan.

Cf. M. Paulin Talabot:
Revue des Deux Mondes: X. 1845

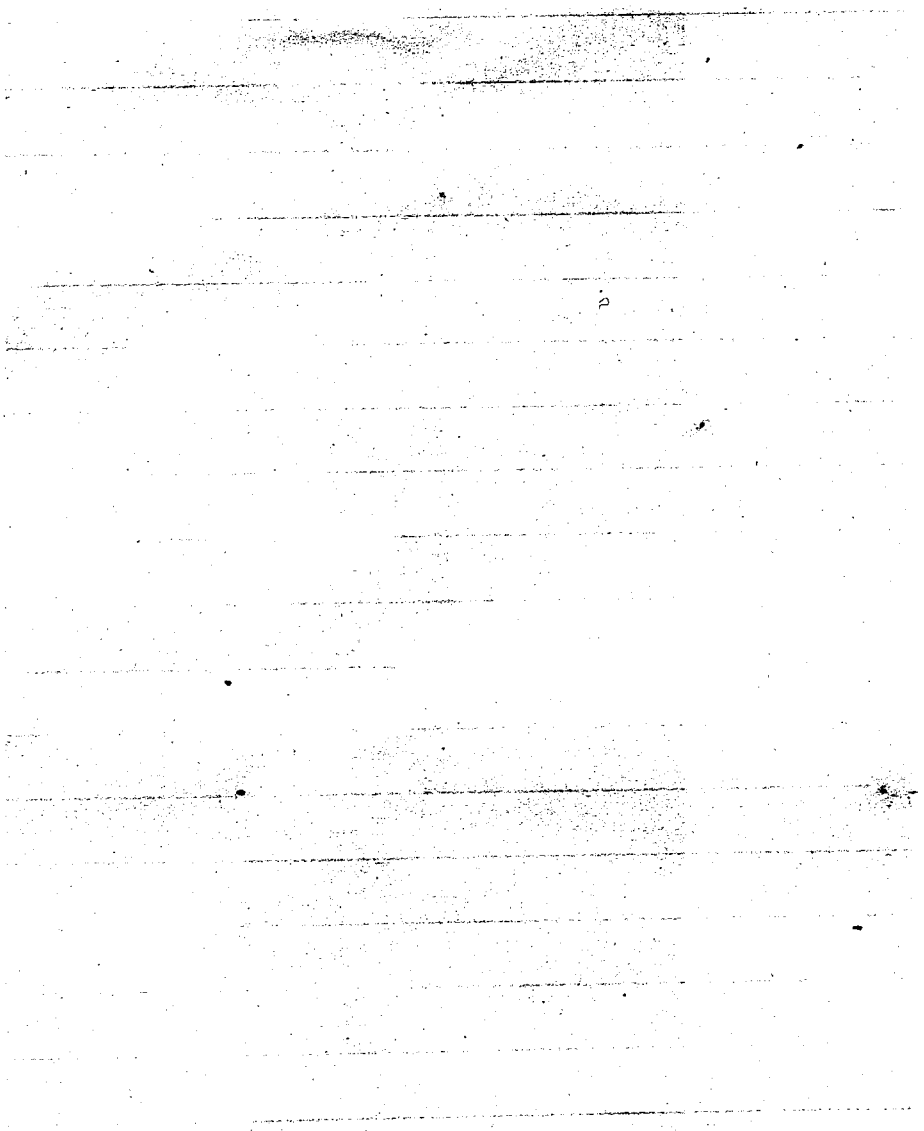
Isthme de Suez.
Echelle de 1/1,000,000. B.

20,000 M 100,000 M
10 0 10 20 30 40 50 60 70 80 90 100



Longitudinal Section of the Nile:
(Diagrammatic after Willcocks)

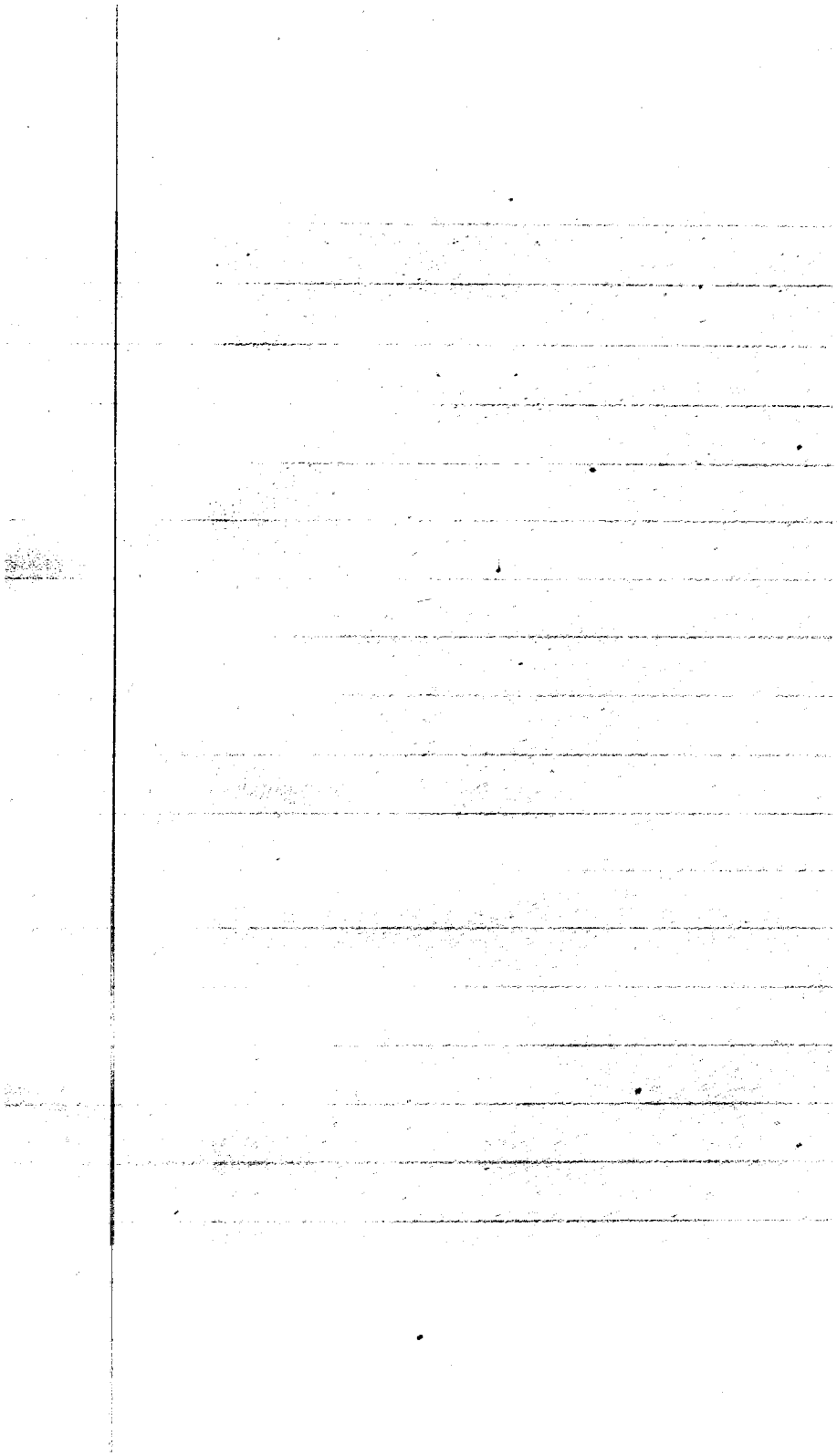
Horizontal Scale 1/12,000,000
Vertical Scale 1/20,000

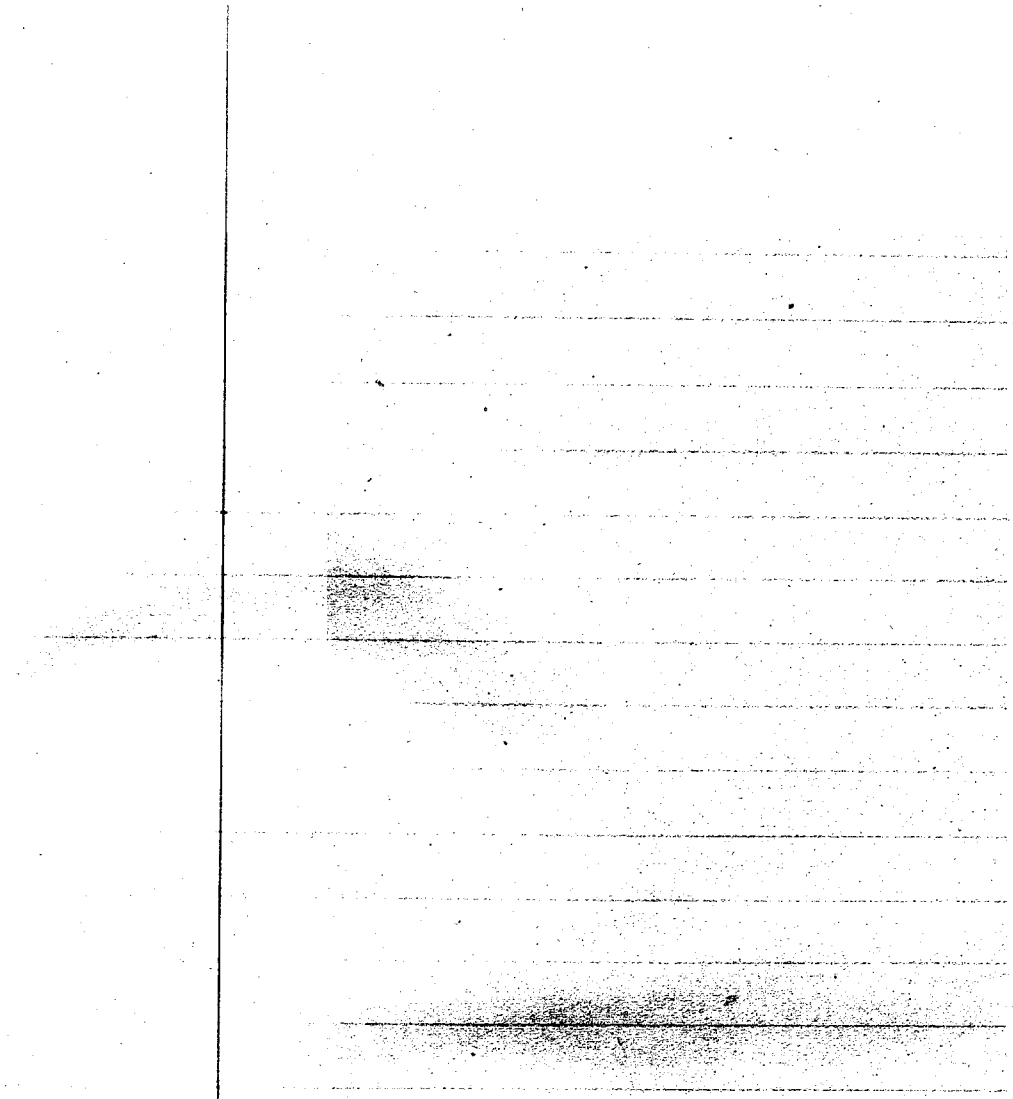


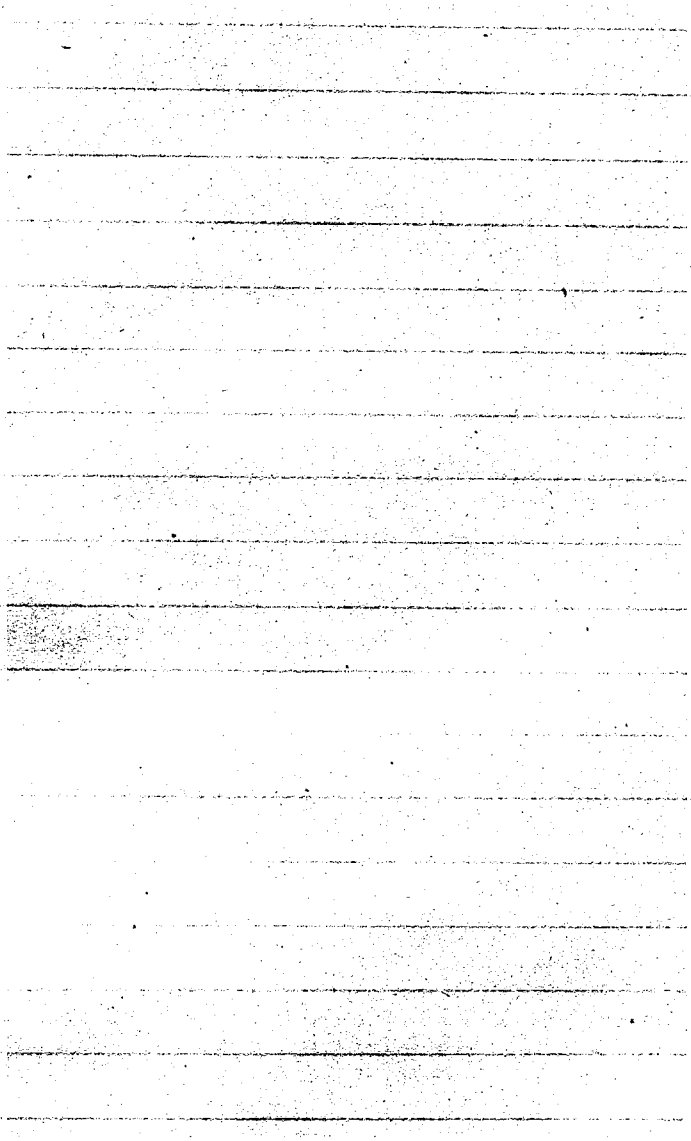
Peutingeri Mapp: Segmentum VI A Bruxelles 1728

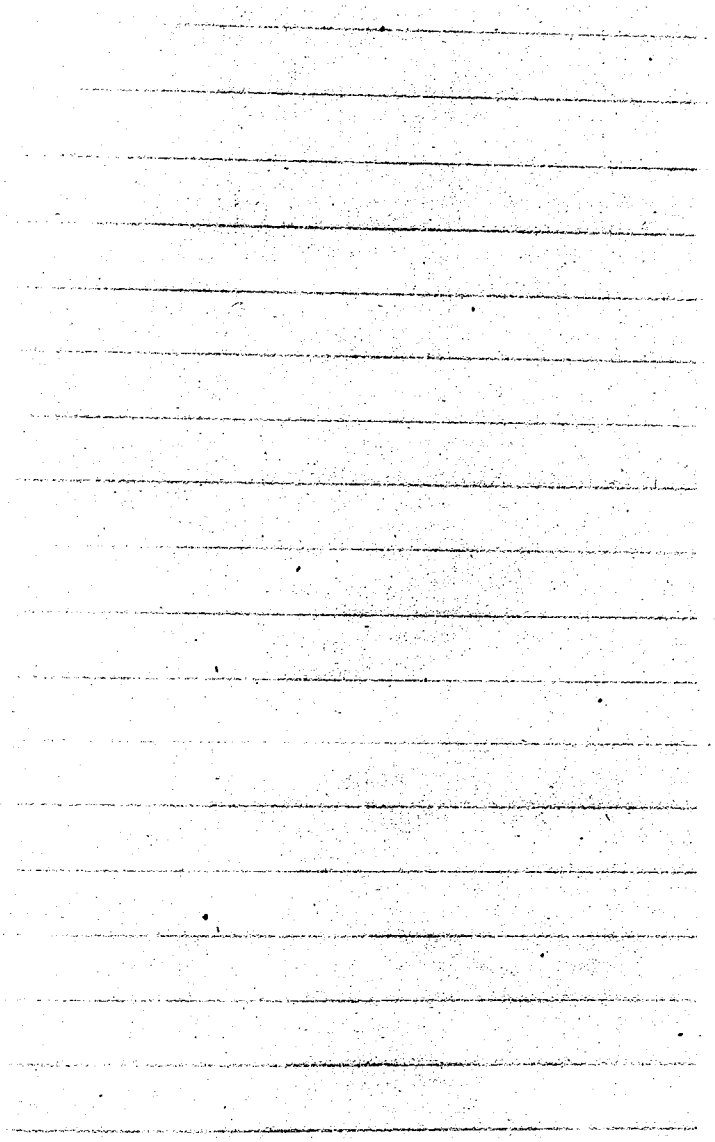
Jean Nicolas Bergier.

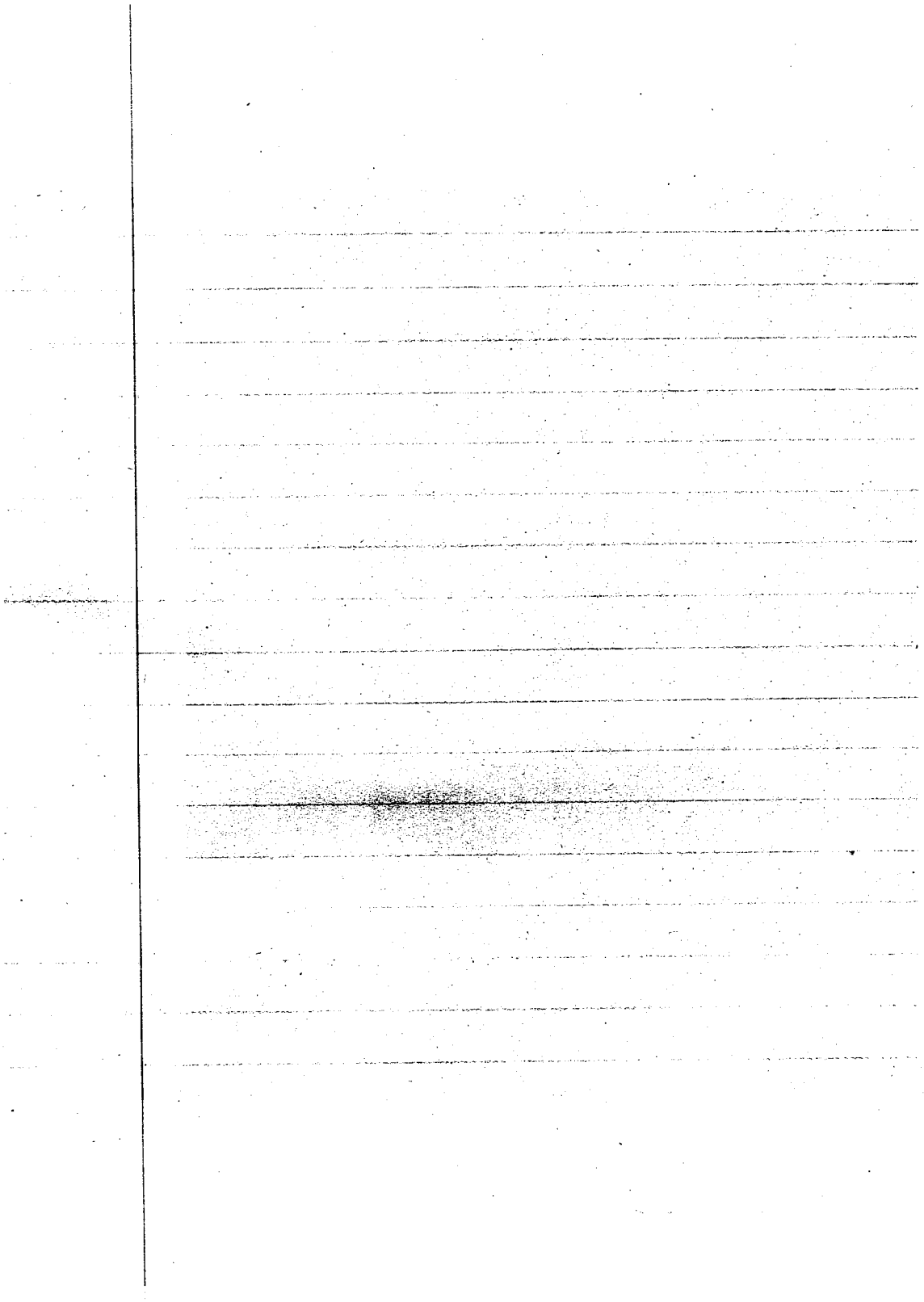

Brücke
Setti's Canal
Brücke
Setti's Canal (?)
5
4
3
2
1

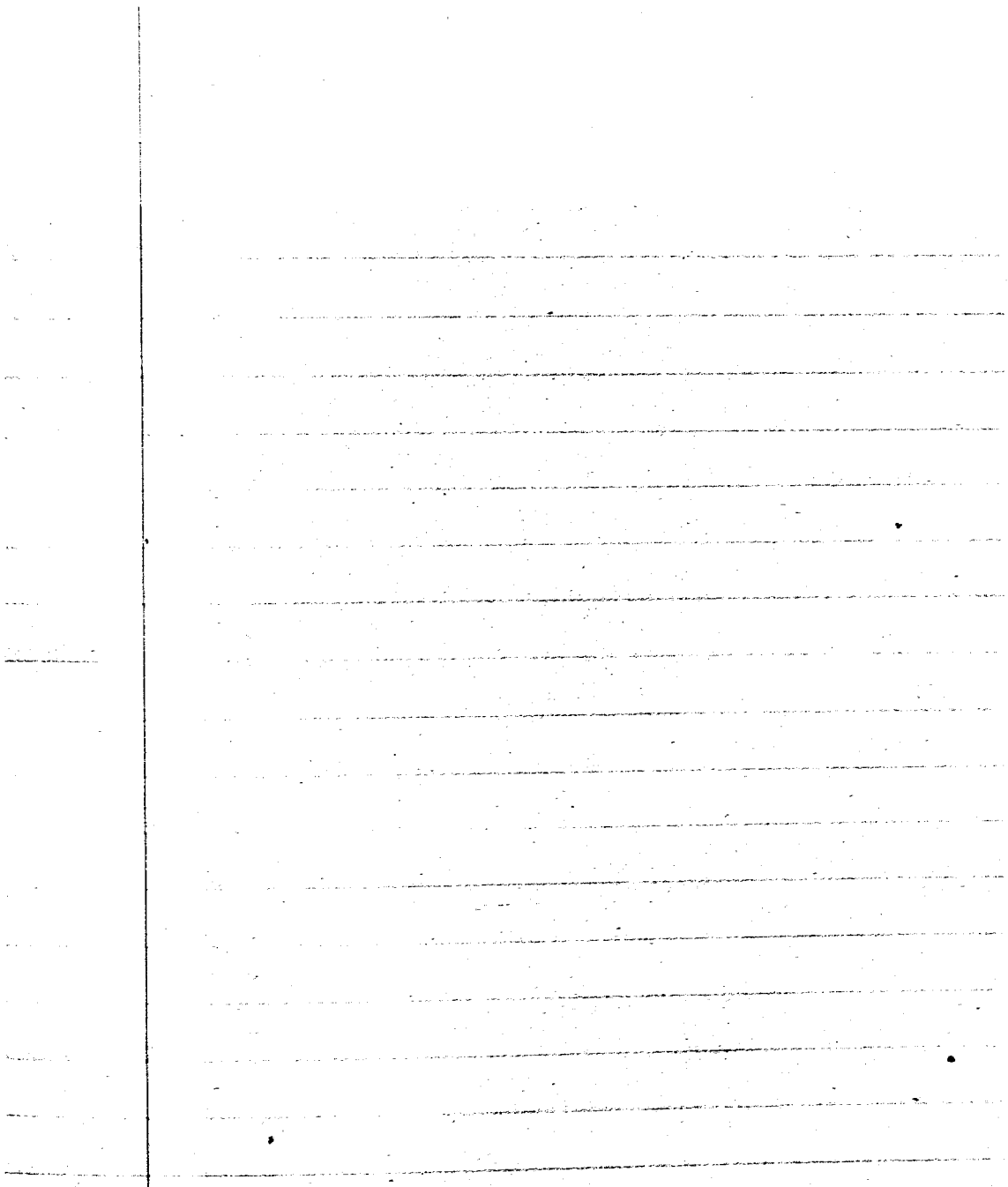












Bibliography:-

1 Abulfeda. Géographie d'Abulfeda: Reinaud (1848-83)
2 Abu Salih. Anecdota Oxoniensia
3 Adams. Genuine Works of Hippocrates i. ii (1849)
4 Agatharchides* in Photius and Diodorus
5 Anecdota Oxoniensia: Semitic Series: Churches in Egypt (1895)
6 Antonine Itinerary. Parthey & Pinder (1847)
7 D'Anville** Memoire et Abrégé de Géog. Anc. (1769) i. ii. iii
8 Appian. Romanorum Historia
9 Ardagh. Nilometers in Proc. Roy. Geograph Soc (1889)
10 Aristides. Orations (Egypt.)
11 Aristotle. Meteora
12 Armandi. Histoire Militaire des Eléphants
13 Arrian. Anabasis of Alexander: also Indica
14 Artemidorus. in Strabo: passim.
15 Athenaeum. 1851: pp 684-
16 Aurelius Victor. Historia Romana i. ii
17 Beale. Oriental Biographical Dictionary
18 Bergier. Histoire des Grands Chemins de l'Empire Romain (1728)
19 Bernard. Pilgrimage of St Silvia of Aquitania
20 Besnier. Lexique de Géographie Ancienne (1914)
21 Bevan. House of Seleucus. i. ii (1902)
* Agathemerus. Γεωγραφίας Ὑποτύπωσις in Müller ii. 471-487
** Aegyptus Antiqua: Map of Atlas

Bibliography

22 Bevan — Short Commentary on Book of Daniel (1892)

23 Bochardt — Nilohe und Nilstandmarken in dynn Nile

24 Bouché-Leclercq** — Histoire des Lagides i-iv (1903-1907)

25 Breasted — History of Egypt (1905)

26 Breasted — Ancient Records of Egypt I-V (1905-1906)

27 Brugsch — Egypt under the Pharaohs: i. ii also Brodricks i (1891)

28 Brugsch — Geograph. Inschrift. i-iii (1857-60)

29 Brugsch — Die Egyptologie (1891)

30 Brugsch — Dictionnaire Geographique .. i.ii (1879. 1880)

31 Buckley — Irrigation Works in India (1893)

32 Budge — History of Egypt i-viii (1902)

33 Bunbury — History of ancient Geography i.ii (1879)

34 Burckhardt — Hierocles (1893)

35 Burton — Excerpta Hieroglyphica (1823-7)

36 Bury — The Ancient Greek Historians (1908)

37 Bury — Edition of Gibbon

38 Butler — The Arab Conquest of Egypt (1902)

39 Butler — The Ancient Coptic Churches of Egypt. i.ii (1884)

40 Carter — in Tr. of Bombay Asiatic Soc. IV (1852)

41 Chabas — Mélanges Egyptologiques (3 parts in 4 vols: 1862-73)

42 Champollion — L'Egypte sous les Pharaons i.ii (1814)

* Bouriant: Makrizi et in Mémoires de la Mission arch. au Caire XVII

** Bouché-Leclercq — Histoire des Séleucides (1913)

Bibliography

43 Champollion Mem de l'Egypte et de la Nubia (1835-45)
44 Cheyne Encyclopaedia Bibl. passim
45 Cheyne Jeremiah: His life & Times (1888)
46 Cheyne Decline & Fall of the Kingdom of Judah (1908)
47 Cooke North Semitic Inscriptions (1903)
48 Corbeaux in Athenaeum of 1851
49 Corpus Inscrip. Latinarum vol iii
50 Corpus Inscript. Graecarum vol iii
51 Cosmas Indico-pleustes. (Winstedt) Chr. Topography (1909)
52 (Cerete) Evans: Essai de classification de cardinaux Romaines (1906)
53 Daressy Cf Recueil de Travaux p 127
54 Davis: Influence of Wealth in Imperial Rome (1910)
55 Dawson: Modern Science in Bible Lands
56 Dawson: Notes on Geology of Nile valley & of Egypt: Evil Mag: New series (1883-1884) Nos 241. 242. 243. 244
57 Description de l'Egypte. Classical extracts of Vols on the Expedit. 1799...
58 Diodorus Bibliothecae Historicae
59 Dio Cassius Hist. Romanorum.
60 Dillmann: in Ab-Sadhi: Cf Genesis ii pp 405-406 (1897)
61 Dodge: Alexander the Great (1890)
62 Driver in Hogarth: Authority & Archaeology (2 edn 1899)
63 Driver Book of Exodus

Bibliography

64 Driver Book of the Prophet Jeremiah (1906)

65 Du Bois Aymé Mémoire sur les anc. Lim. de Mer Rouge &c Descript.

66* Duncker (Abbott) History of Antiquity. I-VI (1877-82)

67 Duncan: The Exploration of Egypt & the Old Testament. (1908)

68 Duruy History of Rome I-VI (1883-6)

69 Duruy History of Greece I-VIII (1892)

70 Ebers Durch Gosen zum Sinai (1872)

71 Edrisi Géographie (Jaubert's translation) t. i. ii (1836-40)

72 Egli Nomina Geographica (1893)

73 Egypt Exploration Fund Memoirs The whole set.

74 Egypt Exploration Atlas

75 Encyclopedia Brit: Passim

76 Encyclopaedia Biblica: Passim

77 Epiphanius Adversus Haereses (Panarion)

78 Erman Life in Ancient Egypt (1894)

79 Eusebius: Church History: also Martyrs

80 Eusebius: Onomasticon

81 Eusebius: Chronica (Venice i. ii. 1818)

82 Evetts Churches & Monasteries of Egypt. Abu Salih in anecdota

83 Finlay History of Greece 7 vols (1877). (Epitome: 1895)

84 Fitzgerald The Great Canal at Suez. i. ii (1876)

* Dümichen: Geograph. Inschrift altäg[1-IV] also Denkmäler

Bibliography

85 Forbiger Handbuch der Alten Geographie i-iii (1842-8)
86 Forster Hist. Geog. of Arabia i. ii (1844)
87 Friedländer Pauly's Scientarius (1912)
88 Gibbon Decline & Fall of the Roman Empire
89 Glaser Sketch of Hist. & Geography of Arabia
90 Glynn Institute of Civil Engineers Vol XC (1850-51
91 Golenischeff Recueil de travaux p. 137
92 Gosselin Recherches sur la Geograph. Syst. I-IV (1798-1813) (1806-78 17 vols
93 Grand Dictionnaire Universal du XIX^e Siecle (Larousse: 1875) Vol. A
94 Gregory The Great Rift Valley (1896)
95 Gregorovius The Emperor Hadrian (1898)
96 Hall Ancient History of the Near East (2nd ed. 1913)
97 Hall Classical Review: Vol xii (1898)
98 Handcock The Latest Light on Bible Lands (1913)
99 Herodotus Rawlinson's: Sayce's &c
100 Herodotus Wheeler: Rennel: &c &c
101 Hicks Manual of Gk. Hist. Inscripts. (1882)
102 Hicks & Hill Manual of Gk. Hist. Inscripts (1901)
103 Hierocles Συνεκδημος
104 Hilprecht Old Babylon. Inscripts. (1893): Explora. in Bible Lands 1903
105 Hippocrates De aere et Locis &c Adams

* Wiedemann: Herodots Zweites Buch (1890): mit ausführlicher

Bibliography

106 Hirsch Handbook of Geograph + Hist. Pathology i-iii (1883·85·86)
107 Hogarth Philip and Alexander (1897)
108 Hogarth Authority + Archaeology (1899)
109 Hohlwein L'Égypte Romaine (1912)
110 Holland Bo. of Geograph Soc. (1866)
111 Holmes Ancient + Modern Ships (i·ii. 1900)
112 Hommel Ancient Hebrew Tradition (1897)
113 Horner: Philosophical Transactions: 1853. 1858.
114 Hull Memoir on Geology & Geograph. of Arabia Petraea (1889)
115 Humboldt Kosmos i. ii (1848)
116 Itineraria Romana: [Parthey] K. Müller (1916)
117 Itin. Ant. August. et Hierosolyma: Parthey & Pindar (1847)
118 Jackson Hydraulic Works: 1885
119 Jaubert Edrisi G.
120 Jewish Quarterly Review: passim
121 Johns: Babylonian + Assyrian Laws (1904)
122 Johns: Assyrian Doomsday Book (1901)
123 Journal of Biblical Literature
124 Journal of Bombay Asiatic Society
125 Journal of Royal Geographical Society

Bibliography

126 Journal of Theological Studies

127 Journal of the Victoria Institute

128 Judd { Proceedings of Royal Soc. xxxix (1885)

129 Judd { Report on Depositn of Nile flood: 1861 (1886)

130 Kellogg* Abraham, Joseph, + Israel in Egypt (1887)

131 Kiepert Atlas of Classical Geog (1861): Lehrbuch alt. Geog: 1887-8

132 King & Hall Egypt + Western Asia: 1907

133 Kittel History of Hebrews i. ii (Taylor) (1895-6)

134 Laurent Study of Ancient Geography i. ii (1830)

135 Lenormant Manuel d'Histoire Anc. de l'Orient. i. ii. iii: 9th edition 1881)

136 Lesseps Percement de l'isthme de Suez: i. ii

137 Letronne Recueil des Inscripts. i. ii (1842. 1848)

138 Letronne+ Recherches Geograph. 1814: Recherches pour servir

139 Lepsius sic Chronologie (1849) à l'histoire (1823)

140 Lepsius Denkmäler aus Eg und Aethiop. (1849-1856).

141 Lepsius Königsbuch (1858)

142 Lepsius Letters from Egypt, Ethiopia, & Peninsula of Sinai (1853)

143 Lieblein Handel und Schiffahrt auf dem R. Meere (1886)

144 Linant-Bey Mémoire sur les principaux travaux d'utilité...

145 Lumbroso Recherches sur l'economie politique de l'Eg (1870)

146 Lublin Dictionnaire des Noms Hieroglph. Supplement (1892)

* Kemp: Engineers' Year Book

+ Letronne Revue des deux Mondes: xxvii: pp 215-235 (1841)

Bibliography

147 Lucian — Dindorf's edition of his works

148 Lyons — Treatise of Surveying & Land Measurement in Egypt (1907)

149 Lyons — Cadastral Survey of Egypt (1908)

150 Lyons — Physiography of the River Nile (1906)

151 Macalister — The Philistines: their history & civilization (1913)

152 M'Curdy — History, Prophecy & the Monuments i. ii. iii (1894-1901)

153 MacLaren — Edinburgh Philosph. Journal xiii. (1825)

154 MacNeile — The Book of Exodus (1908)

155 Mahaffy — Empire of the Ptolemies (1895)

166 Mahaffy — Alexander's Empire (1897)

167 Mahaffy — Petrie's History of Egypt. vol iv: Ptolemaic Dyn (1899)

168 Makrizi — Description Topographique et Historique de l'Égypte: Bouriant (i. ii 1895-1900)

169 Mallet — Les Premiers Établissements des Grecs en Égypte. Cf Mommsen

170 Mannert — Geographie der Griechen und Römer 10 vols (1792-1825)

171 Mariette — Monuments Divers (1872): Deir el Bahari (1877) (Cf Vol X Survey of Western Asia)

172 Maspero — Histoire anc. des Peuples de l'Orient (2nd Ed 1875)

173 Maspero — Dawn of Civilization (1894)

174 Maspero — Struggle of the Nations (1896)

175 Maspero — Passing of Empires (1900) **

176 Mémoires de la Mission Archaeol. au Caire Vol xvii

177 Merivale. History of Rome under the Empire (1850-62)

* Mengin: Histoire de l'Égypte sous le Gouv. de Moh. Aly (1823)

** Maspero: Popular Stories of ancient Egypt (1915)

Bibliography

178 Ed. Meyer Geschichte des Alterthums i-iv (1884-1902)

179 Migne Patrologia: Eusebius: Chrysostom: Athanasius &c

180 Müller Itineraria Romana (1916)

181 Milne History of Egypt under Roman rule (Petrie) (1898)

182 Mommsen Provinces of the Roman Empire i-ii (1909)

183 Muir Sir W. Annals of the Early Caliphate (1883): Weil's Edit (1915)

184 Müller C Geographi Gr. Minores i, ii, also Tabulae (1855)

185 Müller Wm Max: Asien und Europa (1893)

186 Müller Wm Max: Egyptological Researches i (1906): ii (1910)

187 Müller Wm Max: Encyclop. Biblica: Egypt, Exodus, Goshen &c (1901..

188 Murray: Handbook for Egypt (Hall: 1910)

189 Naville: Dêr el Bahari (3rd edit 1888), Goshen (1885 2nd edit).

190 Naville: City of Onias: Bubastis: Dêr el Bahari (1894)

191 Naville: Archaeology of Old Testament (1913)

192 Newbold: Jo of Bombay Asiatic Soc (1848, viii)

193 Niebuhr K: Beschreibung von Arabien (1772)

194 Nobilia Dignitatum: Seeck (1876)

195 Nuovo Dizionario Geografico Universale (12 vols) (1826)

196 Oppert: Records of the Past: New Series: vol v

197 Ordnance Survey of the Peninsula of Sinai: 3 vols (1869)

198 Orelli: Inscriptiones Latinae i. ii. iii (1828-56)

Bibliography

199 Palmer E H: Desert of the Exodus: i. ii (1871)

200 Palmer, Henry: Sinai from the XVIIth Eg. Dyn. & present day (1906)

201 Paulus Silentiarius: Friedlander. ef

202 Petrie: History of Egypt i. ii. iii

203 Petrie: Tanis, Naukratis, i. iii Tanis i. ii & Egyptian Tales i. ii (1895)

204 Petrie: Hyksos & Israelite Cities (1906)

205 Peutinger Map in Berger (1728): also K Müllers Itineraria (1916)

206 Philostorgius: Ecclesiastical History.

207 Pinches O.T. in the light of the Hist. Records of Assyr & Babylon (1903)

208 Pliny: Historia Naturalis (published 77 A.D): (37 Books).

209 Plutarch: Parallel Lives: Specially Alexander, Antony.

210 Pomponius Mela: De Situ Orbis: (Baudet 1843)

211 Ptolemy C.: Geographia (Müllers 1838)

212 Quatremère: Mémoires Geograph. et Histor. sur l'Eg: i. ii (1811)

213 Quarterly Statement of Pal Explor. Fund: London (1878: 1883-4)

214 Rawlinson, Sir H.C: Persian Cuneiform Inscription at Behistun (1846)

215 Rawlinson G: History of Herodotus: i. ii (1858)

216 Rawlinson G: Five Great Monarchies of East: i. ii. iii (1862-67)

217 Rawlinson G: History of Ancient Egypt i. ii (1881)

218 Records of the Past: First Series 12 Vols: Second Series 6 Vols: passim specially [illegible]

219 Recueil de Travaux Eg. & Assyr: ef vii. IX. XI. XIII Darius Stelae

* Randone: Manual of Coal Engineering (1884)

** Photius: Excerpts from Agatharchides: C. Müller Geogr. Gr. Min Vol i

Bibliography

220 Recueil: of Lehmann

221 Revue de deux Mondes: Lehmann XXVII (1841): Jalabert X (1855)

222 Reinaud: of Abulfeda *

223 Ritter: Comparative Geography of Palestine & Sinaitic Pen. I-IV (1866)

224 Robinson: Biblical Researches i. ii. iii (1841)

225 Rogers: History of Babylonia & Assyria: i. ii (1915)

226 Rougé: Textes Geographq. du Temple d' Edfou (1865)

227 Rouge: Géographie anc. de la Basse-Égypte (1891)

228 Ruzière: De la Géographie Comparée et de l'anc. État de la Mer Rouge (1719)

229 Russell: Ancient & Modern Egypt (1831) of Description de l'Eg

230 Rylands: Geography of Ptolemy elucidated (1893)

231 Saint John: Egypt & Mohammed Ali: i. ii (1834)

232 Sayce: Ancient Empires of the East (= Herodot. i. ii. iii (1883)

233 Sayce: Higher Criticism & the Monuments (1894)

234 Sayce: Egypt of the Hebrews & Herodotus (1896)

235 Sayce: Early History of the Hebrews (1897)

236 Schleden: Das Landenge von Suez (1858)

237 Seetzen: Notitia Dignitatum (1876)

238 Sharpe: Chronology & Geography of anc. Egypt (1849)

239 S. Silviae Aquitanae Peregrinatio ad loca Sancta: Gamurrini

240 Smith S. History of Assembly Hall (1821)

* Rennell: Geographical System of Herodotus (1800)

† Rennell: Comparative Geography of Western Asia (1831)

Bibliography.

241 Smith S. History of Sennacherib (1878)

242 Smith S.A. Historical Geography of Holy Land (1897)

243 Smith Wm. Dictionary of Gk + Roman Geography. i. ii

244 Smith Wm Dictionary of Gk + Roman Antiquities

245 Spons: Dictionary of Engineering (1874)

246 Sprenger: Die Alte Geographie Arabiens (1875)

247 Stephanus Byzantius: Ἐθνικά: Westermann (1839)

248 Strabo: Geography. Three volumes

249 Suess Ed. Face of the Earth: Four volumes. Cf Rev Antiq. i. ii. 1888-92

250 Suetonius: Duodecim Caesares

251 Suez Canal: Comptes Rendus de l'Union (1874)

252 Sayce: Tell el-Mukeyyim (1908)

253 Talabot: Cf Revue des deux Mondes (1855)

254 Teuffel + (Schwabe): History of Roman Literature. i. ii (1900)

255 Theophanes*: Historia Orientarum (Wimmer: 1842)

256 Tozer: History of Ancient Geography (1897)

257 Urkunden Griechische: 1895. 1898. 1903. 1912

258 Vente Paola: Cities modernes et villes anc. du Nil. Cf Äg Zeitschrift Sprache (1892

259 Vincent: Voyage of Nearchus: (1809)

260 Vincent: Periplus of Erythraean Sea: (1809)

261 Wiedemann: Äg Geschichte: 2 Vols: (1884)

* Tissot: Statistique de l'Égypte (1873)

Bibliography

262 Weil: Geschichte der Chalifen 1846

263* Wheeler: Geography of Herodotus i. ii (1854)

264 Wiedemann: Äg. Geschichte: 2 Teile (1884)

265* Wiedemann: Herodots Zweites Buch (1890) Not available

266 Wiegall: Life & Times of Cleopatra (1914)

267 Wilkinson Sir S. On decrease of level of Nile: Trans Royal Soc of Lit (2nd series: 1849)

268 Wilkinson Sir S. Manners & Customs of anc Egyptians (Birch) i. ii. iii (1879)

269 Willcocks Sir W. Egyptian Irrigation (2nd edit: 1899)

270 Wilson: Lands of the Bible. i. ii (1847)

271 Wright: Daniel & his Prophecies. (1906)

272 Xenophon: Cyropaedia

273 Zeitschrift für Äg Sprache: Bd xxxiv (1896)

274 Zeitschrift für Äg Sprache Bd xxxii (1894)

* 262a Wesselmg: Synecdemos of Hierocles